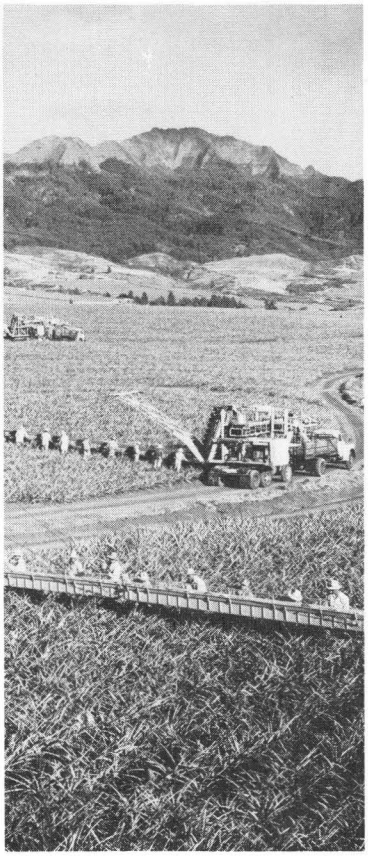
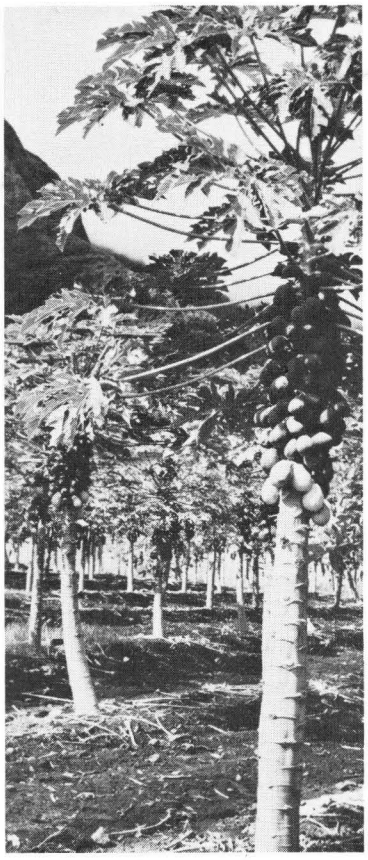
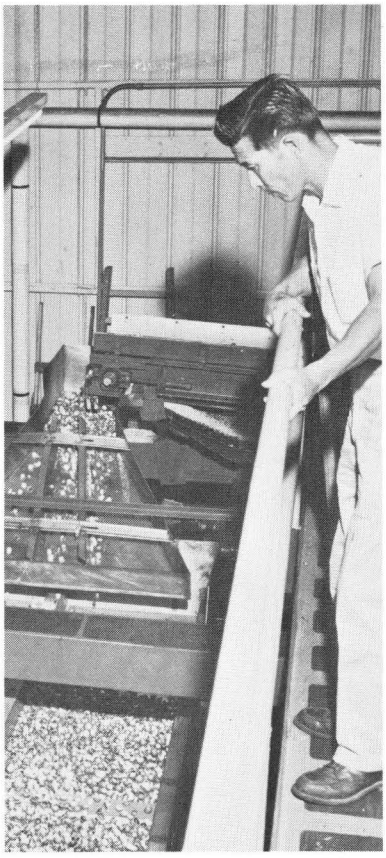
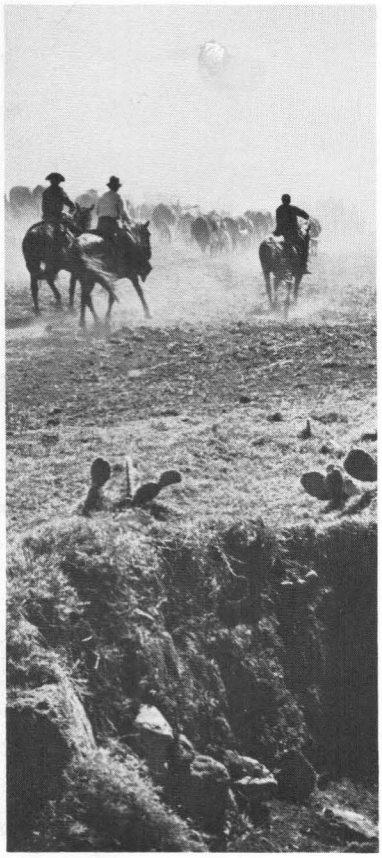
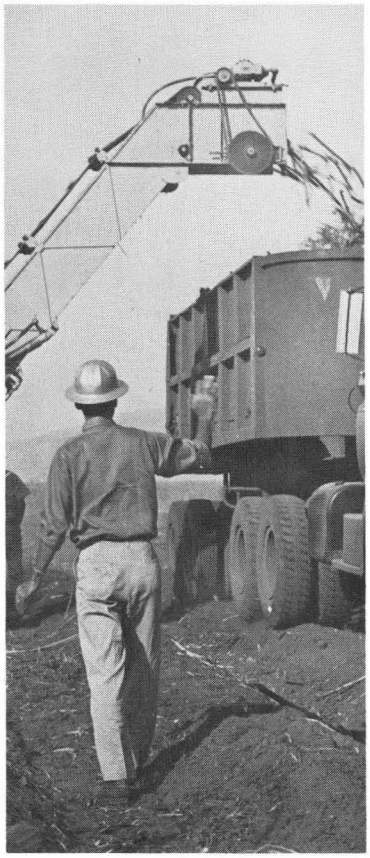
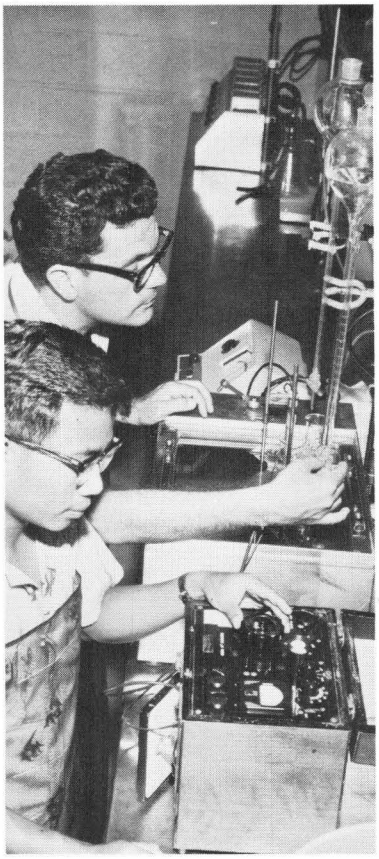





Hawaii's Future Agriculture

PROJECTIONS TO 1975, WITH RECENT TRENDS

J. A. MOLLETT


Hawaii Agricultural Experiment Station, College of Tropical Agriculture, University of Hawaii, in cooperation with the Agricultural Experiment Stations of the Western States/December 1962

AGRICULTURAL ECONOMICS REPORT NO. 59

THE AUTHOR

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PREFACE

This publication is the second major study of a series based on Hawaii's phase of Western Regional Project W-54, "Appraisal of Opportunities for Adjusting Farming to Prospective Markets." The Agricultural Experiment Stations of Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; and the Agricultural Research Service of the U.S. Department of Agriculture are cooperating in conducting various phases of this regional research.

The study on which this report is based is financed by Federal funds authorized under the Hatch Act (amended), and allocated to Project 369 of the Hawaii Agricultural Experiment Station.

The author wishes to express appreciation to his colleagues in the College of Tropical Agriculture for reviewing the data presented in this report; to Dr. Paul P. Wallrabenstein and Mrs. Ethel F. Nihei of the Crop and Livestock Reporting Service, Hawaii Department of Agriculture, for providing the data on which the charts in Part I are based; and to Professor C. W. Peters for contributing the section on floral products.

The photographs were kindly supplied by a number of agencies: Hawaii Visitors Bureau, Foodland Super Market, Ltd., Hawaiian Sugar Planters' Association, Pineapple Companies of Hawaii, Castle & Cooke, Inc., Young Bros., Ltd., Dairymen's Association, R. M. Towill Corporation, and the University of Hawaii. Credit is given to individual photographers, in the photograph captions.

The charts were drawn by Mrs. Thomas H. Fujimura of the Land Study Bureau.

SUMMARY

This study analyzes recent and prospective trends in Hawaii's agriculture. Projections are given for the production of all major commodities through 1975.

The first part of this study examines trends in crop acreages, livestock numbers, production and productivity of both crops and livestock for the 15-year period 1946–60. The second part consists of projections.

A series of 33 charts is included in Part I to show the relevant trends not only for the State as a whole but also for major individual islands.

The most important trends in land use during 1946–60 were as follows: sugar land was relatively steady at about 220,000 acres; pineapple increased from 65,000 acres (1946) to 75,000 acres (1960); grazing land for cattle remained about 1.1 million acres; bearing acreage of coffee went up from 3,400 (1946) to 5,900 (1960), and of macadamia nuts from 875 to 2,375; vegetable acreage fell steadily from 5,700 to 3,450 as did the taro acreage (1,015 in peak year of 1948, 515 in 1960), and the area of rice (215 acres in the peak year of 1947, only 70 acres in 1960); the bearing acreage of bananas remained about 900, while papayas increased their acreage from 360 (1946) to 500 (1960).

Productivity measured in yield per acre or output per animal unit increased in varying degrees for most major commodities.

Notable gains took place in yields of sugar, pineapple, taro, papaya, and several vegetables. No significant changes in yield occurred in coffee, macadamia nuts, rice, bananas, or avocados. Steady and important advances in yield occurred in the production of milk, eggs, and chicken meat, and to a lesser extent in pork and beef.

For some commodities, notably vegetables, higher yields compensated for a reduction in area of land cultivated.

Production of sugar, pineapple, coffee, macadamia nuts, papaya, milk, eggs, chicken meat, and beef was upwards—in several in-

stances—markedly. Output of rice, taro, bananas, and avocados was downwards. The extent of these and other relevant changes is clearly illustrated in the charts given in Part I of this report.

Projections given in Part II are based on several assumptions relating to both the island and external economies. The assumptions used relating to external economies are:

1. The United States population will increase to 230 million people by 1975.
2. The United States labor force and employment will grow equally with population growth.
3. Labor productivity in the United States will rise at about 2½ percent annually.
4. No major wars will occur.
5. Real income per capita will increase about 2½ percent annually between 1960 and 1975.
6. Current trends in popular national consumption habits will continue.
7. Prices in general will remain at about current levels both for the agricultural and the national economy.
8. Total consumption of farm products in the United States will rise between 35 and 40 percent between 1960 and 1975.

The additional set of assumptions relating to Hawaii's economy are:

1. The State's population will rise to 865,000 by 1975.
2. The number of tourists annually visiting Hawaii will be about 1 million by 1975.
3. Employment in the State will grow equally with population.
4. Real income per capita will increase at the projected national rate of 2½ percent annually between 1960 and 1975.

In addition, alternative assumptions relating to the production of individual commodities were used. For example, under one assumption island milk production in 1975 was projected at 90 million quarts, or about 70 percent above the 1958–60 level. Under another assumption where price competition was more intense, production was projected at a considerably lower level.

Significant increases in output are projected for sugar, pineapple, macadamia nuts, papaya, milk, eggs, chicken meat, beef, and floral products. Less significant increases are projected for pork, bananas, avocados, and vegetables. Reduction (or cessation) of production is projected for coffee, rice, and taro. Considerable uncertainty is projected for the production of passion fruit, guava, oranges, tangerines, and selected vegetables (particularly cucumbers, snap beans, Italian squash, bell peppers, eggplant, and tomatoes).

Expansion in livestock production is projected to be based to an increasing extent on by-products of the sugar and pineapple industries and on other forage crops (alfalfa, for example) raised locally.

Projected output expansion in Hawaii is largely based on radical improvements in yields, per acre or per livestock unit, a compound effect of improved techniques of management, scientific research, more intensive use of land and water, and continually greater dependence on the rest of the economy for inputs—a result of greater specialization in production methods.

Second Printing, December 1965

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Hawaii's world-famous image—Waikiki Beach and Diamond Head. The State's basic industry is agriculture, however.(Hawaii Visitors Bureau.)

Hawaii's Future Agriculture

PROJECTIONS TO 1975, WITH RECENT TRENDS

J. A. MOLLETT

INTRODUCTION

This study analyzes current and prospective trends in Hawaii's agriculture. The probable direction of change is indicated for major commodities or groupings of similar commodities to 1975. Such projections are not exactly forecasts. They show what changes in production, livestock numbers, and crop acreages can be expected under a given set of assumptions.

In recent years the United States Department of Agriculture has prepared and published several projections of the national long-range supply and demand position of farm products. This work has been done so that farmers, legislators, and administrators of farm programs would not be entirely in the dark as to likely future changes in conditions of supply and demand.

This study has a similar purpose: to provide a general picture of the State's agriculture in 1975 based on definite assumptions as to world, national, and local economic and political changes, population growth, demand structure, interregional competition, and other pertinent factors. The first part of the study analyzes recent (1946–60) trends in island production of the major commodities, or of groups of similar commodities. This information provides a useful basis for the projections to 1975 which are discussed in the second part of the report.

Part I. Recent Trends in Farm Production in Hawaii, 1946-60

A series of charts based on data collected annually by the Hawaii Crop and Livestock Reporting Service provides the main basis for this analysis of recent trends in farm production. These charts are designed for a definite purpose—to clearly and precisely show trends. The text is written mainly to supplement the information shown in the charts. Generally, the trends shown in these charts are relatively easy to see, but care is needed in checking the scale of any change. The charts are not designed to show rate of change (a semilogarithm scale chart is used for that purpose) but to show change in absolute quantities (hence, an arithmetical scale is used). Data analyzed for each commodity or for each major group of commodities, for example, vegetables, generally relate to changes in acreage (or in animal numbers), in production, in location of production (by islands), and in yield per acre (or per animal unit). Trends in crops are examined first, then in livestock and livestock products.

This study does not make projections for all sections of Hawaii's agriculture. It makes no reference to the potential development of the 1.2 million acres of land designated as "forest reserve." This does not imply that forestry is unimportant in the Islands but that its future is worthy of a separate inquiry. Other products which are omitted from discussion are such minor items as honey and beeswax, lamb and mutton, and tallow.

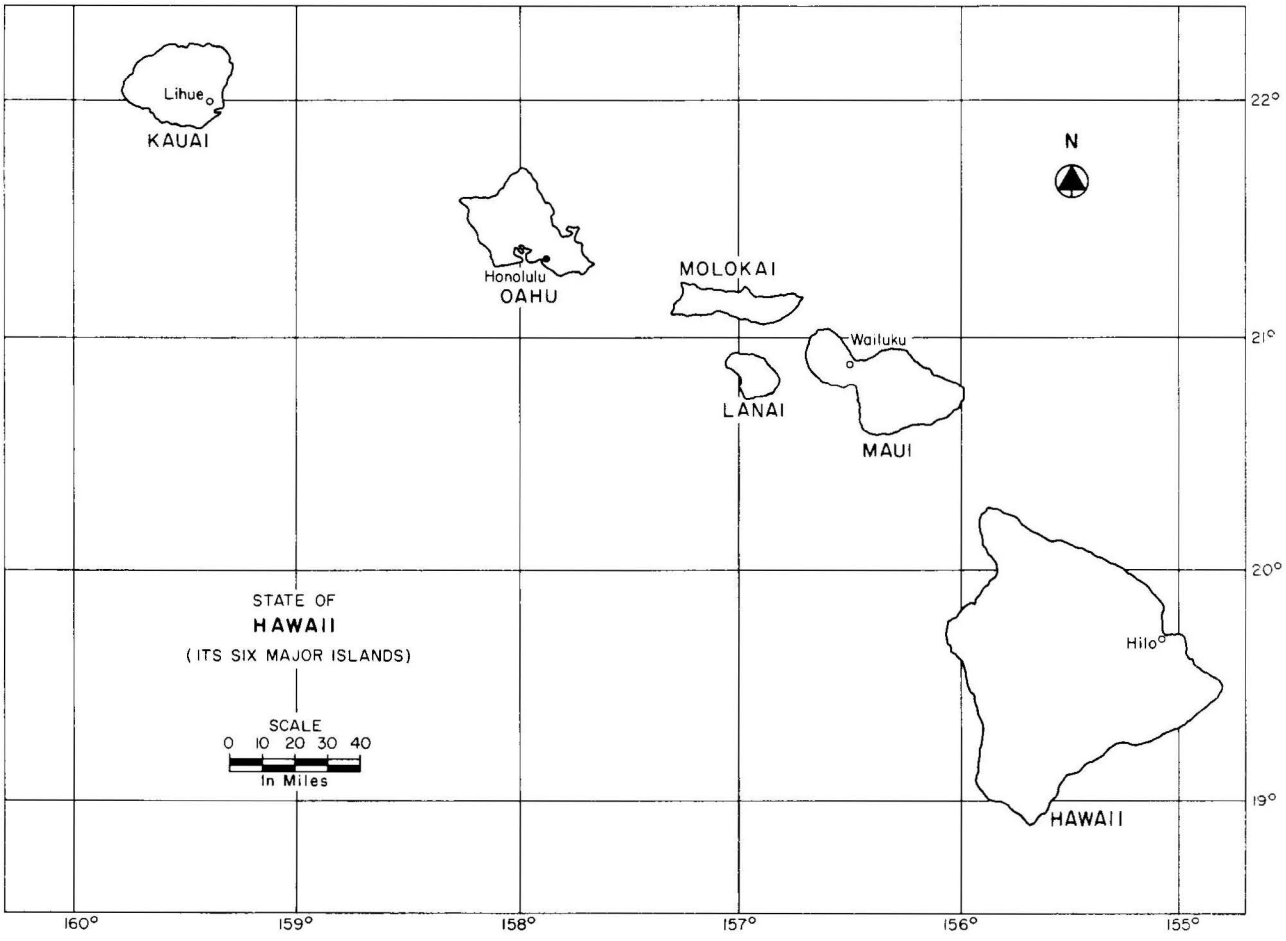
Figure 1 shows the location of the major islands in the Hawaiian chain. Figures 2 and 3 set the stage for the detailed analysis which follows, showing respectively the main uses of agricultural land in the State and the gross value of agricultural output between 1946 and 1960. The dominance of sugar and pineapple in the Islands' agricultural economy is clearly demonstrated. It may surprise many to see what a large proportion of land is used for grazing (figure 2).

ACREAGE, LOCATION, PRODUCTION, AND YIELD OF MAJOR CROPS, 1946–60

Sugar

The area of land in sugar since World War II ended has been about 220,000 acres (figure 4), or about 70 percent of the State's area of arable land. Sugar growing declined in the war years of the 1940's, owing to labor shortages and other production difficulties. A return to prewar levels (238,000 acres in 1936–

FIGURE 1



39) has not been accomplished since 1946; the current level was attained by 1950 (after declining due to a 6-month strike of sugar workers in 1946) and has been about that level since.

The area of sugar cane harvested annually in Hawaii is usually just under one-half of the total area in cane. It was about 108,000 acres for the period under review (1946–60). Only during 1946 and 1958 was acreage harvested significantly different from this average figure (84,400 in 1946; 84,100 in 1958) —a result of the relatively long strikes by plantation workers.

The distribution of sugar lands, by islands, has not changed very much in the 15-year period. The island of Hawaii has kept its acreage at about 100,000, or just under half the State's total sugar lands. The island of Kauai comes next with between 45,000 and 48,000 acres—slowly increasing its sugar lands. Then comes Maui, taking up third position with from 40,000 to 42,000 acres; and, finally, Oahu, the most densely populated island in the Hawaiian chain, with acreage in sugar slowly dropping from 37,000 (1946) to 34,000 (1960).

The production pattern, by islands (figure 5), shows Hawaii as the main source of sugar, contributing roughly double the production of each of the other three sugar-producing islands. But higher yields on the other islands reduce the ratio from 2½ to 1 in sugar land on Hawaii and the other islands to 2 to 1 in sugar production. The trend in production on all four islands—except in the strike years —was upwards.

Yield per acre for the State (figure 6) moved upwards after sharp dips in the two strike years and/or in the years immediately after the strike years. Yields went from 8.06 tons of sugar in 1946 to a peak of 10.74 tons in 1955.

The most significant change influencing production in the island sugar industry during 1946–60 was clearly in yield per acre. Economic conditions generally discouraged an expansion in the area of sugar land. Suitable land for expansion was scarce and its preparation for the growing of sugar was generally too costly. Further, the protective quota system of the Federal Sugar Act which is im-

FIGURE 2

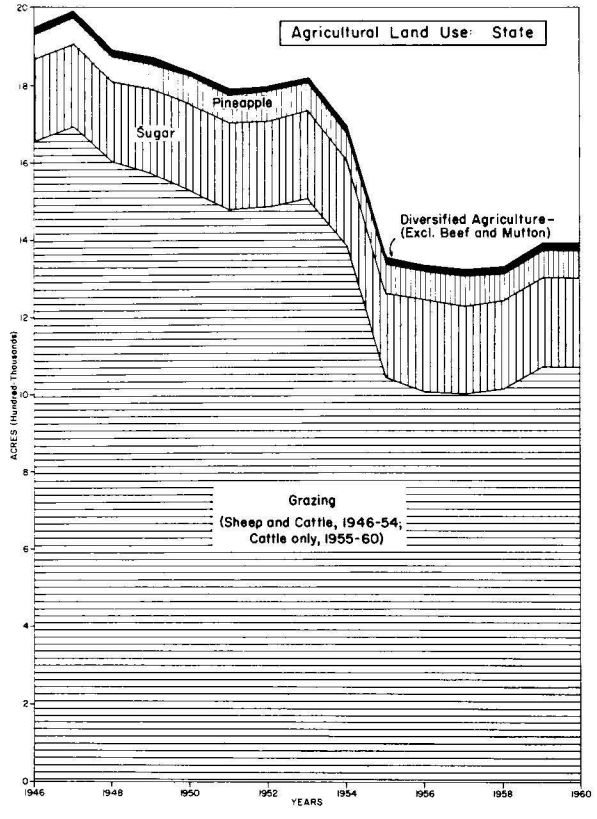
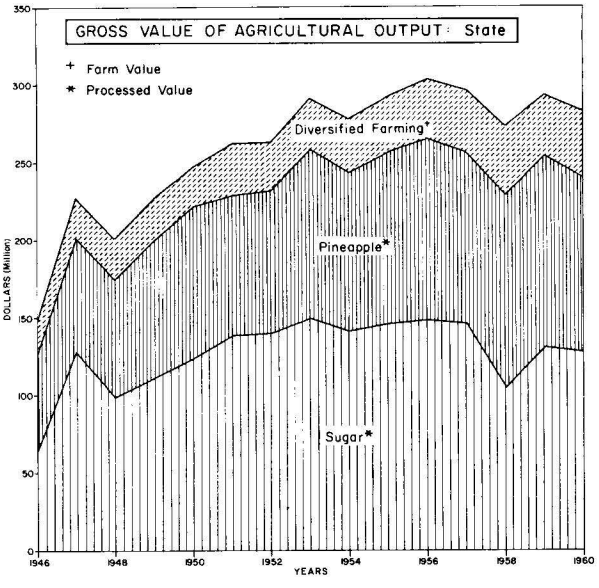
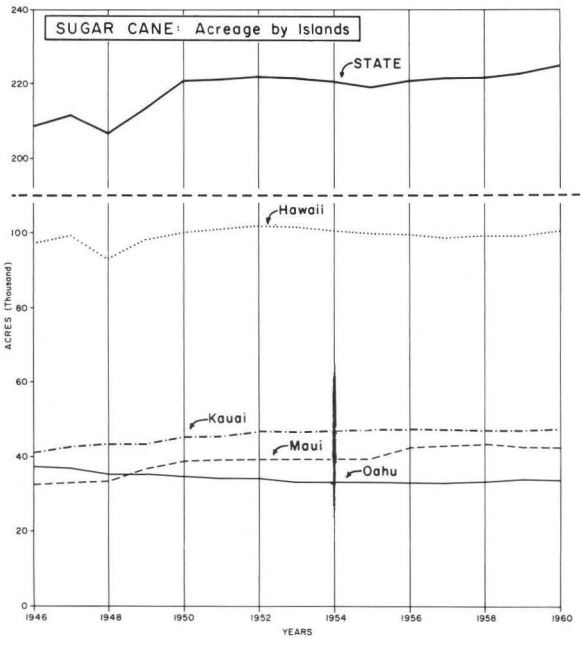


FIGURE 3



Harvesting sugar cane: Current methods are labor saving but wasteful in other ways.(Camera Hawaii.)

FIGURE 4



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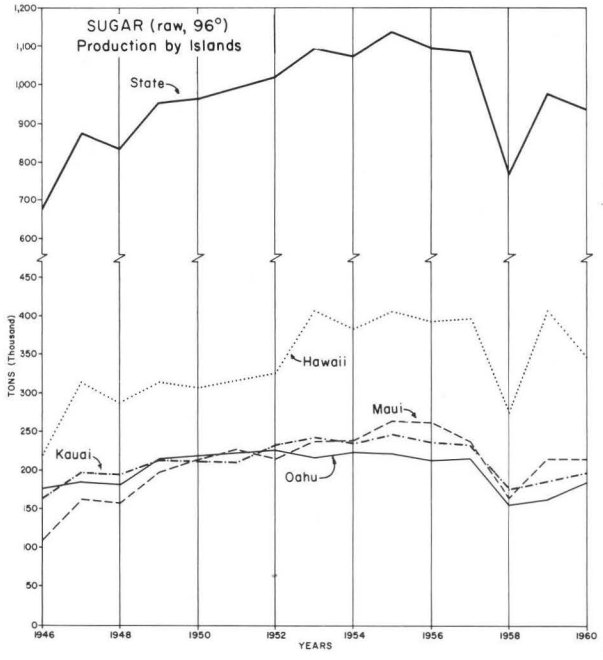


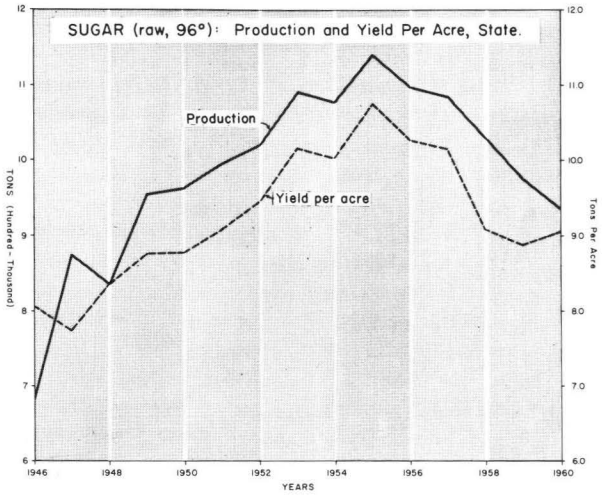


FIGURE 6

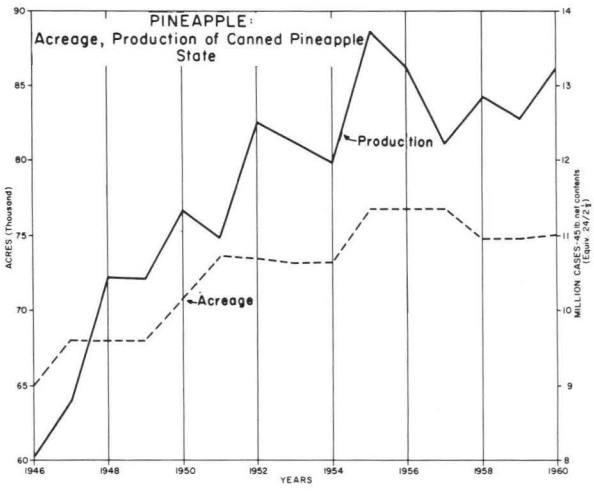


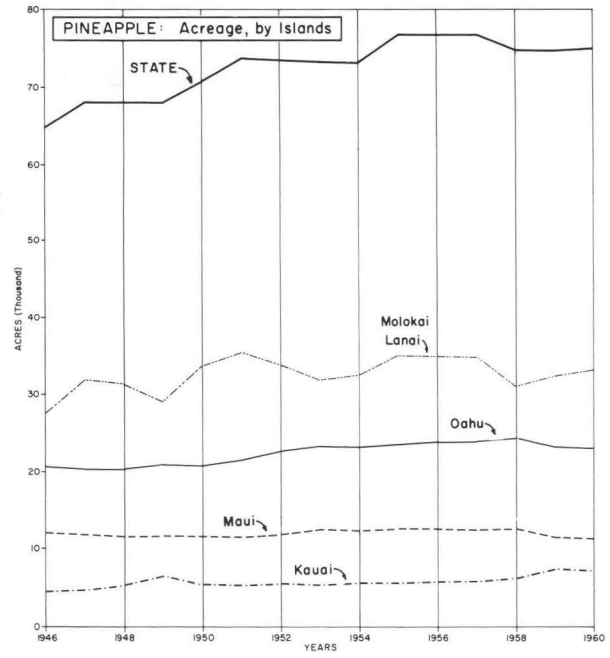
FIGURE 8

perative for the survival of Hawaii's sugar industry, on anything like its present scale, was a factor discouraging expansion.

Pineapple

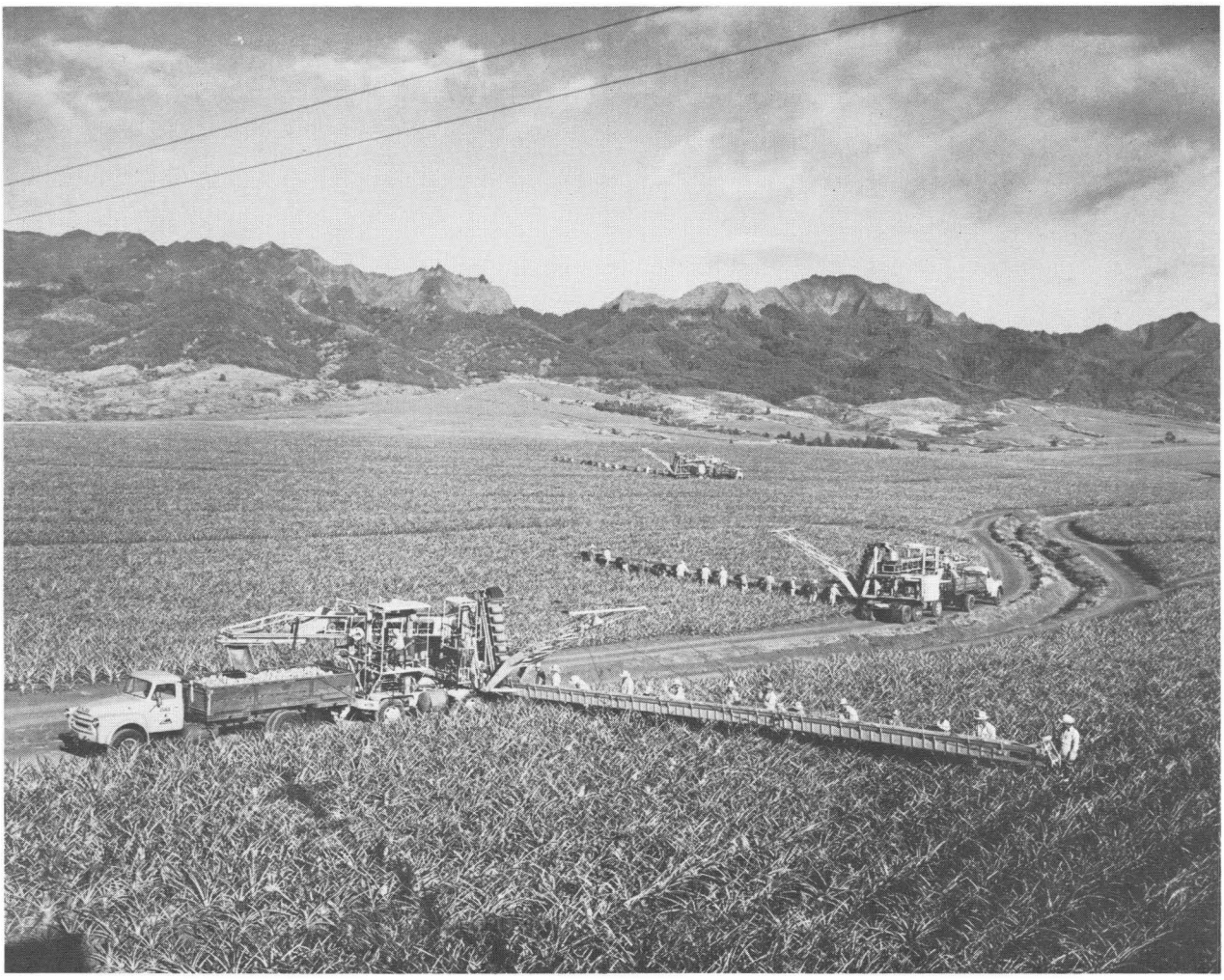
Five islands grow pineapple commercially in the State of Hawaii—two of them, Molokai and Lanai, produce very little else. Figure 7 shows that the pattern of distribution of pineapple land, by islands, has remained fairly steady since 1946. The State's area of pineapple land rose from 65,000 acres in 1946 to 76,700 acres in 1955–57, and then declined slightly to 75,000 acres in 1960. Oahu, the island with the largest pineapple acreage throughout the period 1946–60 (about 23,000 acres), shared in this rise, as did Kauai (about 5,500 acres) with the smallest pineapple area. Maui's pineapple land remained close to 11,000 acres throughout the period under review. Most of the expansion was on the islands of Molokai and Lanai (reliable acreage data for the two islands separately are not available)—up from 27,000 in 1946 to 31,300 in 1960 (roughly 16,300 acres on Molokai and 15,000 acres on Lanai).

FIGURE 7



Production of canned pineapple (not by itself a completely accurate indicator of the yield of pineapple in the field) rose from 8 million cases in 1946 (24 No. 2½ cans, 45-pound equivalent) to a peak of 13.7 million cases in 1955—a 75 percent increase. Annual production has been 12 million cases, or over, since 1952.

This significant rise in pineapple production was caused not only by the increase in pineapple acreage, already outlined, but by a substantial gain in the yield of this fruit. Not only did the tonnage of pineapple harvested per acre increase, but also the quantity of suitable pineapple flesh (for canning)—from each ton of pineapple. Data relating to yields of



Harvesting pineapple: It must be picked exactly ripe. Machines with conveyors nearly 60 feet long collect fruit in bins which are rushed to the canneries. In the peak season, fruit harvesting often goes on day and night. A scene on the island of Oahu. (R. Wenkam.)

pineapple in the field are not available, nor are data about the changes in quantity of canned pineapple derived from a ton of the harvested fruit. However, gains in yield at both field and cannery were significant (figure 8).

Greater production during 1946–60 reflected an expansion in both domestic and foreign demand for Hawaiian canned pineapple.

Coffee

The bearing acreage of coffee, all grown along the Kona coast on the island of Hawaii, almost doubled between 1946 and 1960 (figure 9). The main cause of this upward shift was a sharp rise in parchment coffee prices between 1949 and 1951, followed by steadily rising prices through 1957. The average (annual) price rose from 19.6 cents per pound in 1949 to 36.9 cents in 1951 and eventually to a peak of 50.4 cents in 1957. The impact of these rising prices on the bearing area of coffee took several years to show its full effect. More immediate impact is shown by the sharp increase in the nonbearing coffee-growing area from only 100 acres in 1953 to 1,420 acres in 1955. The rise in the bearing acreage became significant around 1955, and between 1956 and 1957 an increase of 1,100 acres (or of 30 percent) took place. The bearing area rose to a peak of 5,900 acres in 1960 (2,500

acres above the 1946 level) but had declined by 800 acres to 5,100 acres in 1961. New plantings reached their peak in 1958 (1,500 acres) before dropping sharply to only 290 acres in 1960.

The cause of the slowing down and eventual halt to expansion was the relatively drastic fall in parchment coffee prices after 1957 from 50.4 cents per pound to 26.8 cents per pound in 1960.

Coffee production fluctuated much more violently than bearing acreage as a result of diverse changes both in yield per acre and in bearing acreage. But the trend in total output was upwards in the 1950's, at a peak in 1958 with 18.5 million pounds; output was at its lowest point in 1950 with 5.4 million pounds and it stayed below 9 million pounds in late 1940's.

No pronounced upward trend in yield per acre is apparent. The most noticeable feature of the yield pattern is the wide annual fluctuations. Yield was up to 3,700 pounds per acre in 1958, down to only slightly about half that quantity (1,900 pounds) in the year following, and lowest in 1950 at 1,600 pounds per acre.

Macadamia Nuts

One of the most notable changes in Hawaii's cropping pattern since 1946 has been the relatively large increase in the area of macadamia nut orchards (figures 10, 11, and 12). The bearing area of these delectable nuts remained about 875 acres between 1946 and 1952 and then mounted rapidly as plantings made in earlier years became ready for harvesting. Bearing acreage increased to just over 1,750 acres by 1956 and in 1960 had reached 2,375 acres—almost 3 times the comparable 1946 figure.

The nonbearing acreage (figure 12) rose very swiftly between 1946 and 1953 when a peak of 1,700 acres was reached. The trend was then downwards (1,250 acres to 1956), and by 1960 the nonbearing area of maca-

FIGURE 9

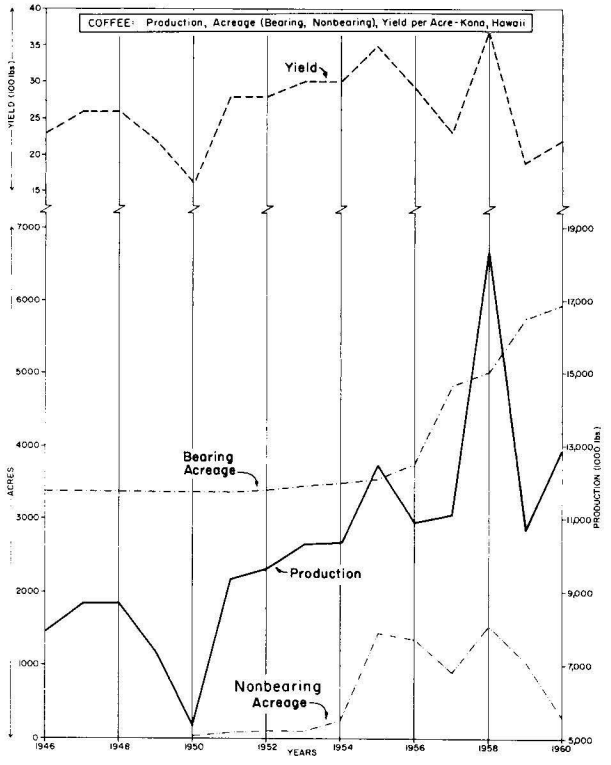
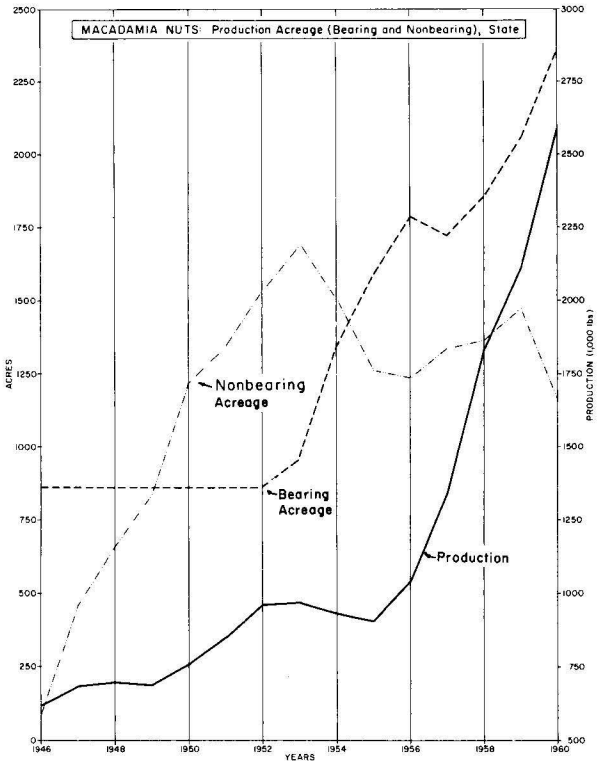


FIGURE 10



damia nut orchards was down to 1,150 acres —but still significant as compared with the situation before 1950.

Figures 11 and 12 show that most of the land devoted to growing macadamia nuts is on the island of Hawaii. Total area (bearing and nonbearing) for Hawaii in 1946 was 745 acres out of the State's total of 950 and it was 2,830 acres in 1960 out of the State's total of 3,510 acres of macadamia nut orchards. The island of Maui took second place in 1960 with 355 acres (bearing and nonbearing). This was a sharp increase from only 14 acres in 1946. Maui's 1960 acreage of macadamia nut orchards was greater than the combined area of such orchards on the islands of Kauai (185 acres), Oahu (135 acres), and Molokai (2 acres). New plantings on Kauai and Oahu were relatively small between 1946 and 1960.

Macadamia nut processing: Nuts passing through the vibrator and grader. (R. T. Kanemori.)

Macadamia nut orchards: Near Hilo, on the island of Hawaii. The bearing acreage of such orchards increased from 875 in 1946 to 2,375 in 1960. (R. Wenkam.)

FIGURE 11

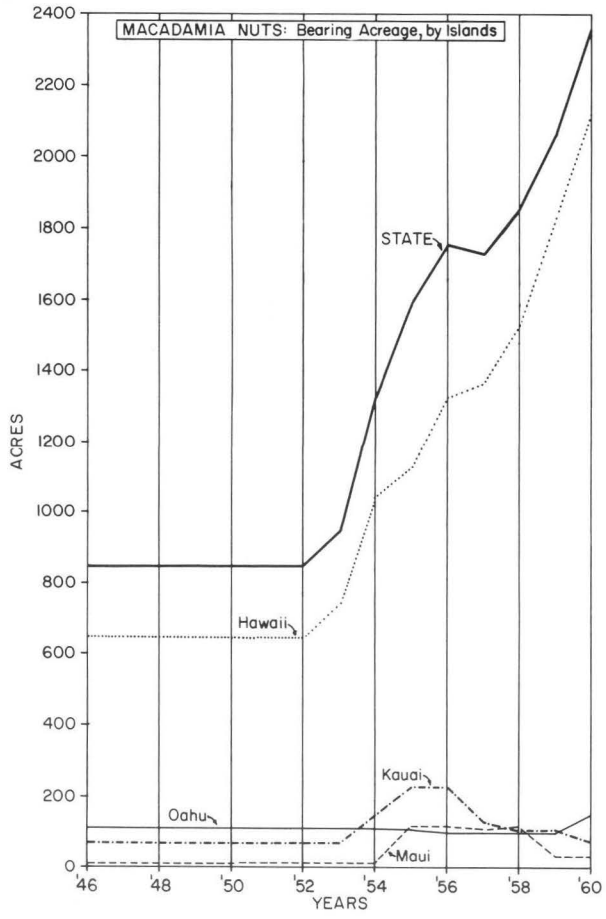
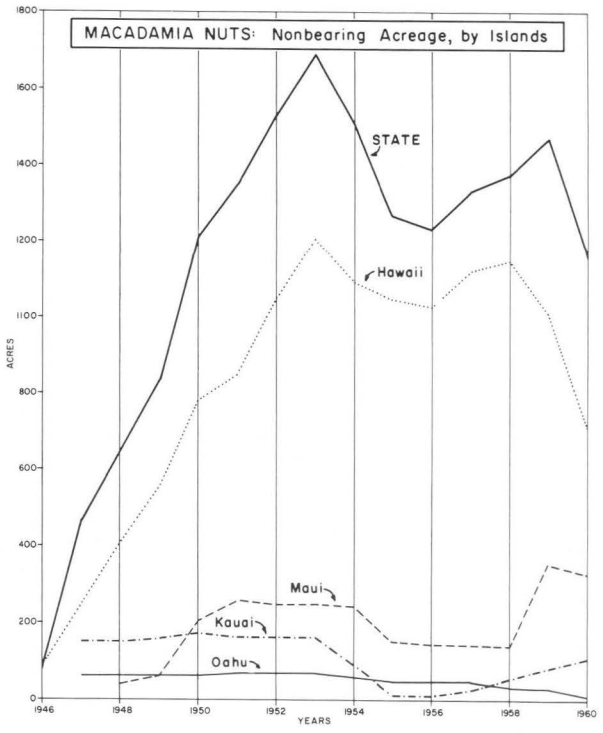


FIGURE 12



The State's production of macadamia nuts increased at a fairly fast rate throughout most of the 15-year period (figure 10). At first the quantities involved were relatively small. Then, from 1956 onwards the annual rise in production became notable not only in terms of percent change but also in change of absolute quantities. Production went up from 1.0 million pounds in 1956 to 2.6 million pounds in 1960.

Yields per harvested acre showed no clear trend during the 15-year period under review.

Rice

In contrast to the upward trend in the area of macadamia nut orchards, rice acreage has

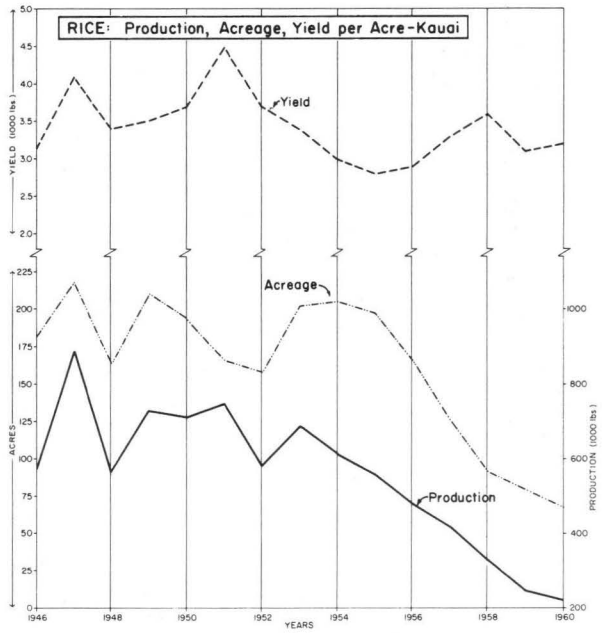


FIGURE 13

Rice: A slowly dying industry on the island of Kauai. The stooping position of the two workers is one reason why. (Hawaii Visitors Bureau.)

undergone a pronounced downward shift (figure 13). Between 1946 and 1954 the State's rice area (all located on the island of Kauai) fluctuated between 160 (1948) and 215 acres (1947) before it persistently moved downwards to only 70 acres in 1960.

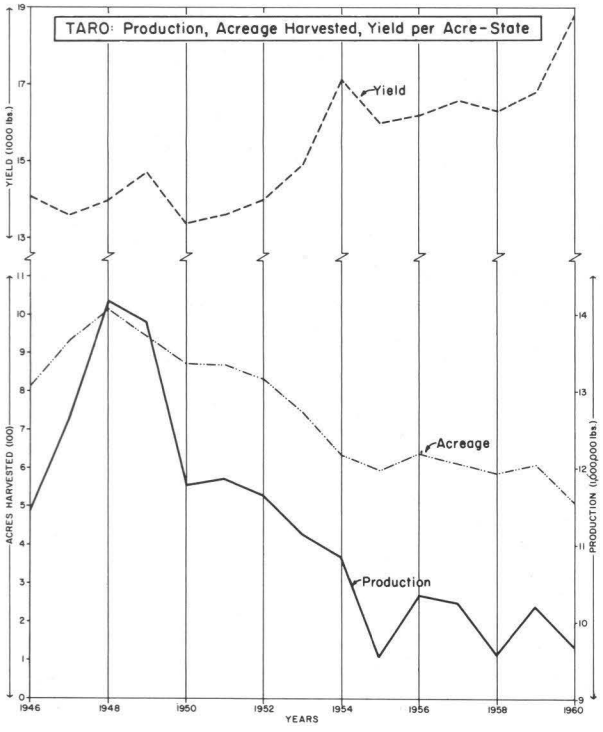
Annual production followed a very similar pattern to that of the acreage changes—from a peak of just under 900,000 pounds in 1947 to just over 200,000 pounds in 1960.

No significant upward or downward shift in yield per acre was apparent for the period 1946–60. Yields per acre varied considerably from year to year (figure 13), from a peak of 4,500 pounds in 1951 to a low of 2,800 pounds in 1955.

Taro

The State's area of taro declined from 1,015 acres in 1948 (up 200 acres above the 1946 figure) to 515 acres in 1960—a drop of 500 acres (figure 14). The distribution of taro acreage, by islands, has also significantly changed since 1946 (figure 15). At that time,

FIGURE 14



Taro: Production of this traditional island source of starch is slowly declining. The taro root grows in several inches of water and is pounded into a paste in the first process of making poi. (Hawaii Visitors Bureau.)

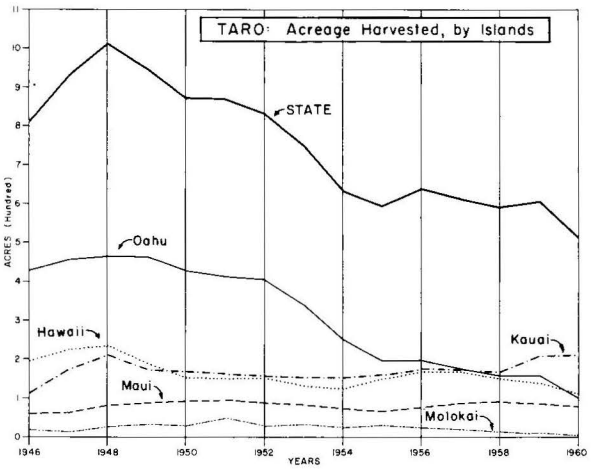
Oahu was the chief taro producer with 425 acres in the crop—52 percent of the State's total; Hawaii came next (200 acres), then Kauai (110 acres), Maui (60 acres), and lastly Molokai (20 acres). This pattern was already changing by 1950 with gains in taro acreage for Maui (up 30 acres) and Kauai (up 60 acres) largely at the expense of Hawaii (down 40 acres). At this stage, Oahu's taro acreage had changed very little. But in the 1950's, Kauai moved into first place and by 1960 had 210 acres in taro (40 percent of a smaller total). Oahu's taro area fell drastically from 425 acres in 1950 to only 100 acres in 1960, Hawaii's dropped to 115 acres in 1960 (160 in 1950), Maui's taro area was fairly constant (80 in 1960; 90 in 1950), while Molokai practically ceased taro production.

This recent upward shift in Kauai's taro area is all the more outstanding for taking place in the face of a substantial drop in the State's taro area.

Taro production in recent years has not fallen at the same rate as taro acreage, as yields have generally risen (check scale care-

fully). Average annual yield per acre (figure 15) for the 4-year period, 1946–49, was 14,100 pounds, compared with the corresponding figure of 17,100 pounds for the 4-year period, 1957–60. Annual average production of taro for these two periods was 13.1 million pounds and 9.9 million pounds, respectively.

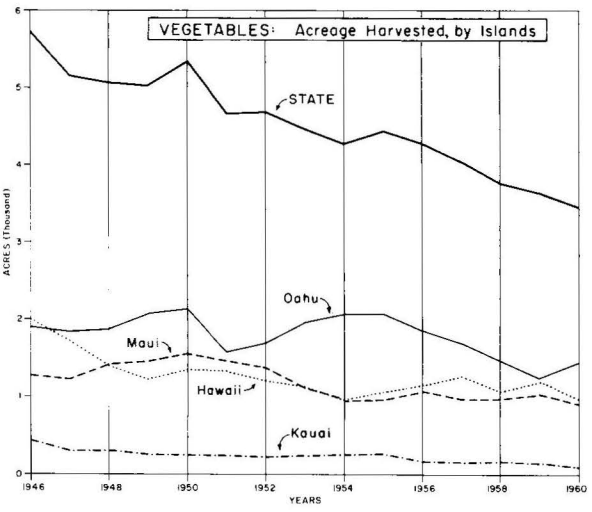
FIGURE 15



Vegetables

The area planted in vegetables has undergone a significant decline for the State as a whole since 1946. Yet production has not changed very much as a result of more intensive use of land. Improved varieties, better methods of cultivation, new herbicides, and application of heavier quantities of fertilizer have all contributed to higher-yielding vegetable crops—and an economy in land use. The total area in vegetables harvested dropped rather steadily from 5,700 acres in 1946 to 3,450 acres in 1960—a reduction of 2,250 acres. The volume of vegetables marketed annually averaged 49.2 million pounds for 1946–49 and 49.4 million pounds for 1957–60. Admittedly, this measure of change is not very precise, as the assortment of vegetables marketed was not exactly the same in both these 4-year periods, but it conveys the right impression, nevertheless.

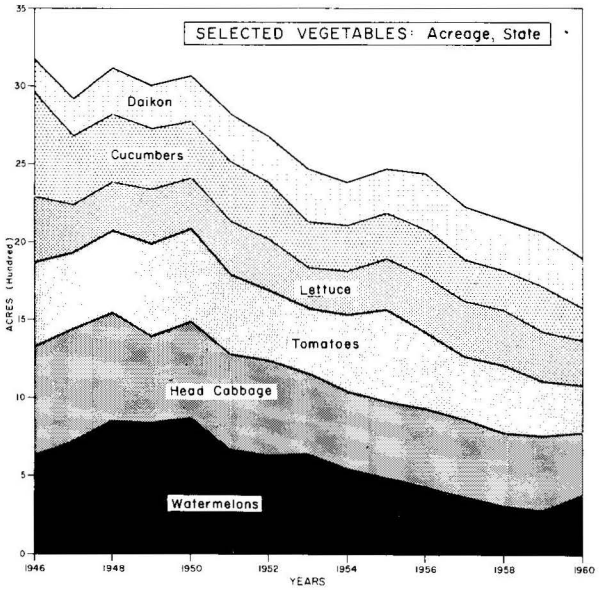
FIGURE 16



Vegetable acreage harvested declined on each of the four supplying islands between 1946 and 1960 (figure 16). The relative order of importance of each vegetable-producing island changed in several respects. Oahu gained first place among the four islands in the size of its vegetable acreage (1,900 acres in 1946; 1,420 acres in 1960), but Hawaii (2,000 acres in 1946; 970 acres in 1960) moved from first to second place. Maui, whose vegetable area changed little in absolute amount during the 15-year period (1,280 acres in 1946; 915 acres in 1960), retained third place. Kauai's small area of plantings fell from 440 acres in 1946 to 120 acres in 1960.

Figure 17 shows the general downward trend which took place in the six (out of a

FIGURE 17

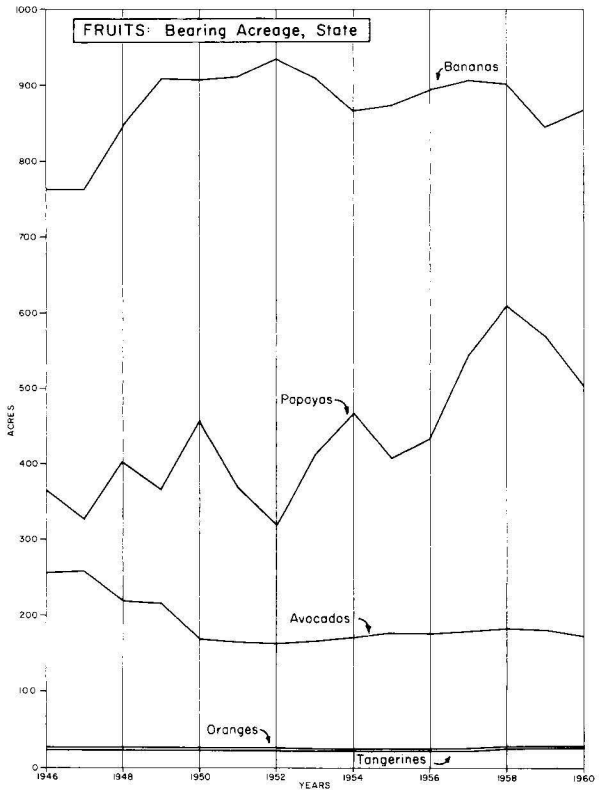


total of 28 vegetables) vegetables—daikon, cucumber, lettuce, tomatoes, head cabbage, and watermelon—which were most important in terms of acreage. The trends clearly shown in figure 17 are equally valid for the other vegetables ranging from the somewhat exotic lotus root (66 acres in 1960) and the ginger root (32 acres in 1960) to the more commonplace cauliflower (31 acres in 1960). Detailed changes in the importance of these relatively minor crops are not discussed in this report, but relevant data are conveniently available in the annual *Statistics of Hawaiian Agriculture* (Hawaii Crop and Livestock Reporting Service).

Most notable improvements in yield per acre during 1946–60 were for snap beans, head cabbage, cauliflower, cucumber, dasheen, dry onions, tomatoes, and watercress.

Although it is noteworthy that island vegetable production remained steady between 1946 and 1960, it is significant that *no* increase in production took place. With an expanding market at their doorstep it may well be asked, why local farmers did not increase their share of it? It was not a shortage of land which led to this failure, because land was actually retired from vegetable production. The answer to this problem is not simple; it involves mainly the competitive advantage of large-scale vegetable growers in California, Arizona, and Oregon, the outmoded island marketing system for locally-grown produce, high risks associated with the Honolulu produce market, and low earnings associated with small-scale vegetable production. It is perhaps significant that total market supplies of vegetables in the State have steadily fallen since 1958 in spite of a rising population. The trend towards greater use of processed (frozen, canned, or dried) vegetables seems likely as the cause of this situation.

FIGURE 18



Fruits

Figure 18 shows the relative importance, in bearing acreage, of the fruits grown commercially in the State except passion fruit (see figure 25). The order in magnitude of area used is bananas, papayas, and avocados in roughly a 9–5–2 acre ratio, followed much lower down the scale by oranges and tangerines (25–30 acres each) grown mostly on the island of Hawaii.

Bananas

The bearing area of bananas in the State has remained at about 900 acres for most years since 1946. Figure 19 indicates that Oahu was by far the most important banana-producing island between 1946 and 1960—with about 800 acres in the crop between 1949 and 1957. Since 1957 it is significant that the banana acreage on Oahu has dropped by 100 acres to just over 700 acres (in 1960) and that the island of Hawaii's bearing acreage has risen to 110 in 1960, from only 35 acres in 1955. Both Maui's and Kauai's banana plantings are small (both less than 30 acres in 1960) and little absolute change in area of

plantings occurred in the period under review.

Yields per acre of bananas for the State as a whole fluctuated violently between 1946 and 1952—from a high of 12,400 pounds to a low of 6,500 pounds (figure 20). Since then yield has averaged about 7,500 pounds per acre with much less fluctuation.

FIGURE 19

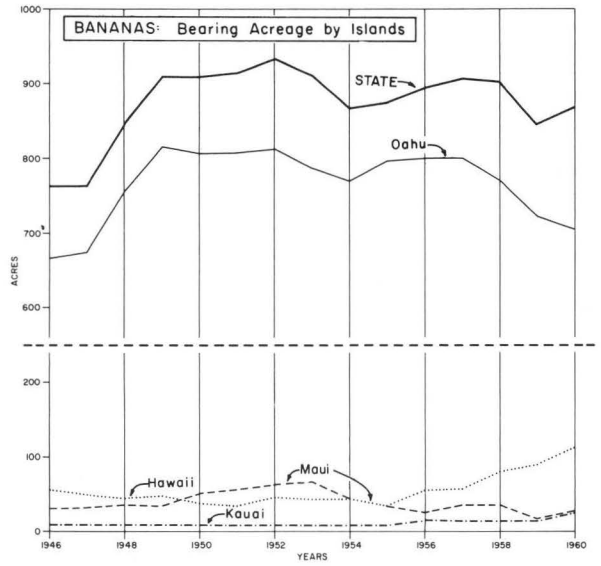
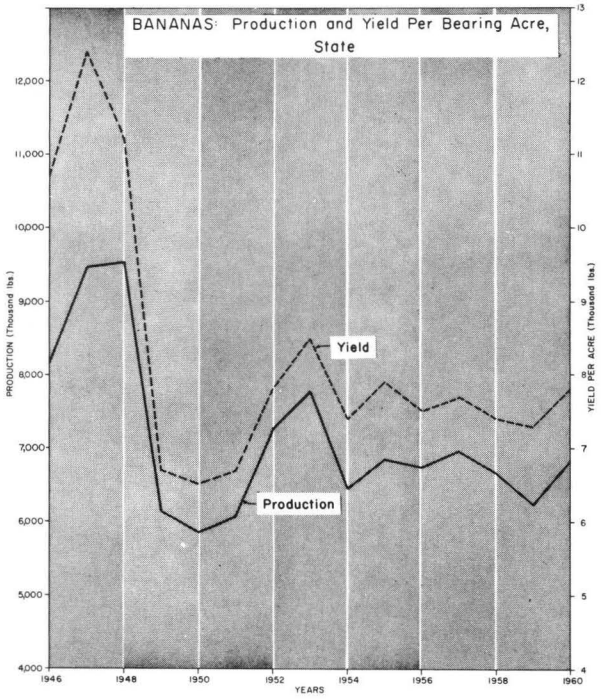


FIGURE 20

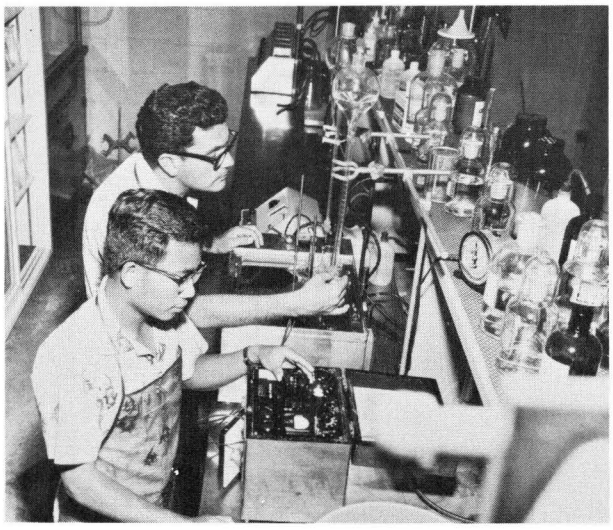


Papayas

The area of papayas has shown considerable oscillation since 1946 although the trend has been upwards (360 acres in 1946, 500 acres in 1960). The most interesting change in papaya production during the period under re-

Papaya: A typical orchard scene on Oahu. Many small Hawaiian farmers place high hopes on this fruit. (Masao Miyamoto.)

Papaya: Research at the Food Science and Technology Department, Hawaii Agricultural Experiment Station, to determine enzyme activity in extracts of the succulent papaya. (Masao Miyamoto.)



view has been the rapid shift to Hawaii as the most important producing island and the movement of Oahu from first to second place (figure 21). These trends can be discerned since about 1950. The papaya acreage on Hawaii rose from 30 acres in 1950 to 315 acres in 1960; Oahu's fell from 405 acres to only 160 acres in the same period. Maui—the other major papaya-producing island—had less than 30 acres in the fruit throughout the 15-year period and no significant change occurred in the papaya acreage there.

FIGURE 21

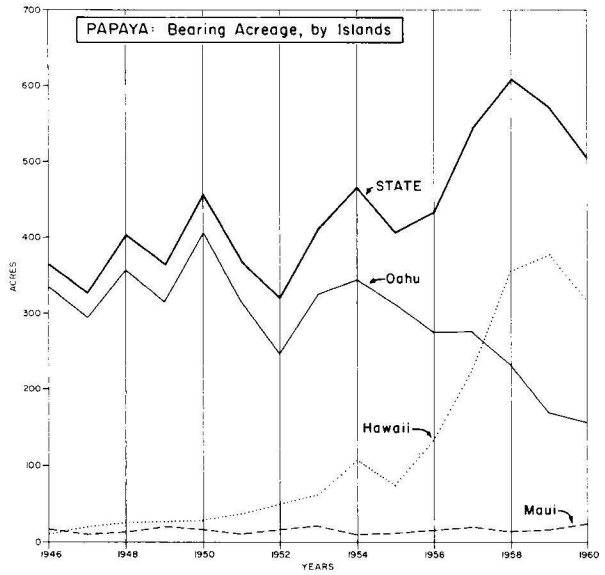
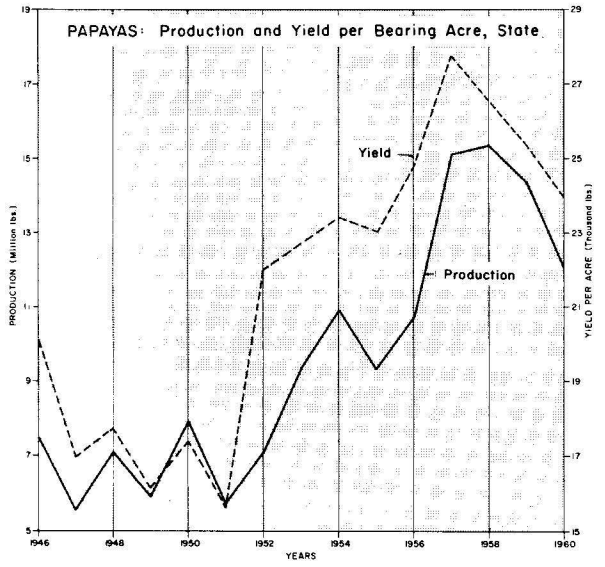


FIGURE 22



Papaya production generally increased at a greater pace than acreage as a result of striking gains in yield per acre (figure 22).

Avocados

The State's area of avocados has been about 175 acres since 1950 (figure 23), after falling rather sharply from the 1946 level of 265 acres. This drop of 80 acres in avocado plantings occurred on Oahu alone, relegating this island from second to third place (below Maui) in order of rating. Hawaii has slightly increased its avocado acreage since 1946 (from 165 to 190) while Maui's has remained at about 40 acres. As mentioned above, Oahu's avocado acreage has fallen sharply since 1946, from 120 (1946) to only 20 (1960).

Avocado production has fluctuated con-

FIGURE 23

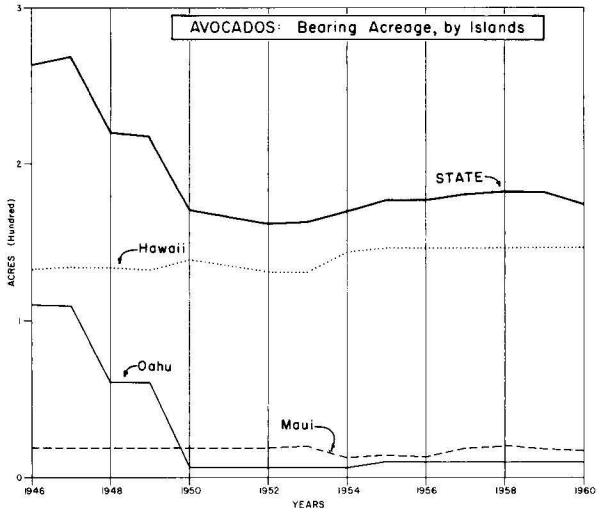
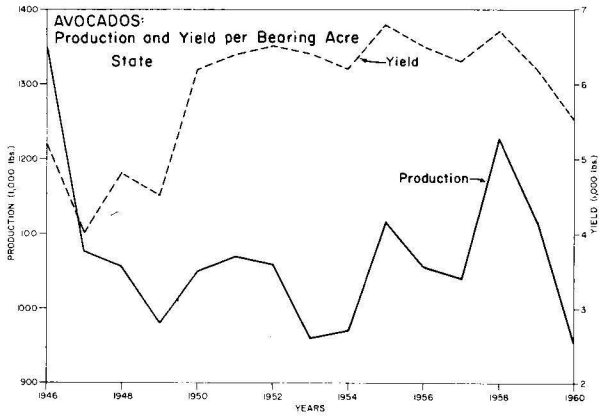


FIGURE 24



siderably from year to year but improved yields (data not too reliable) have offset the fall in the State's avocado acreage to some extent (figure 24).

Passion Fruit

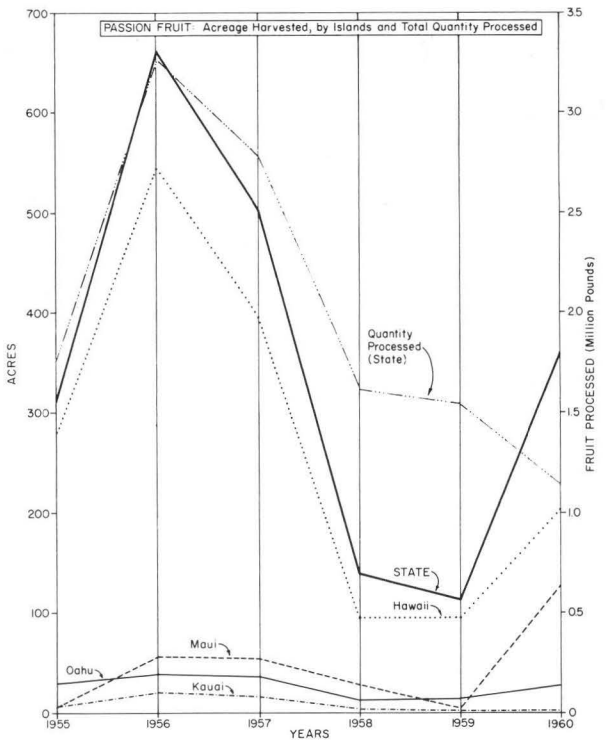
No reliable figures are available before 1955 on the quantity of passion fruit harvested for processing into juice or the acreage planted or harvested. Figure 25 shows the changes which took place in island acreages of this fruit and in total harvesting since 1955.

The total (State) area harvested fluctuated violently, in this short period, from a peak of 665 acres in 1956 (325 acres only a year earlier) to a low of only 113 acres in 1959 and then up again to 365 acres in 1960. The primary cause of these violent changes in acreage harvested was unsettled marketing conditions.

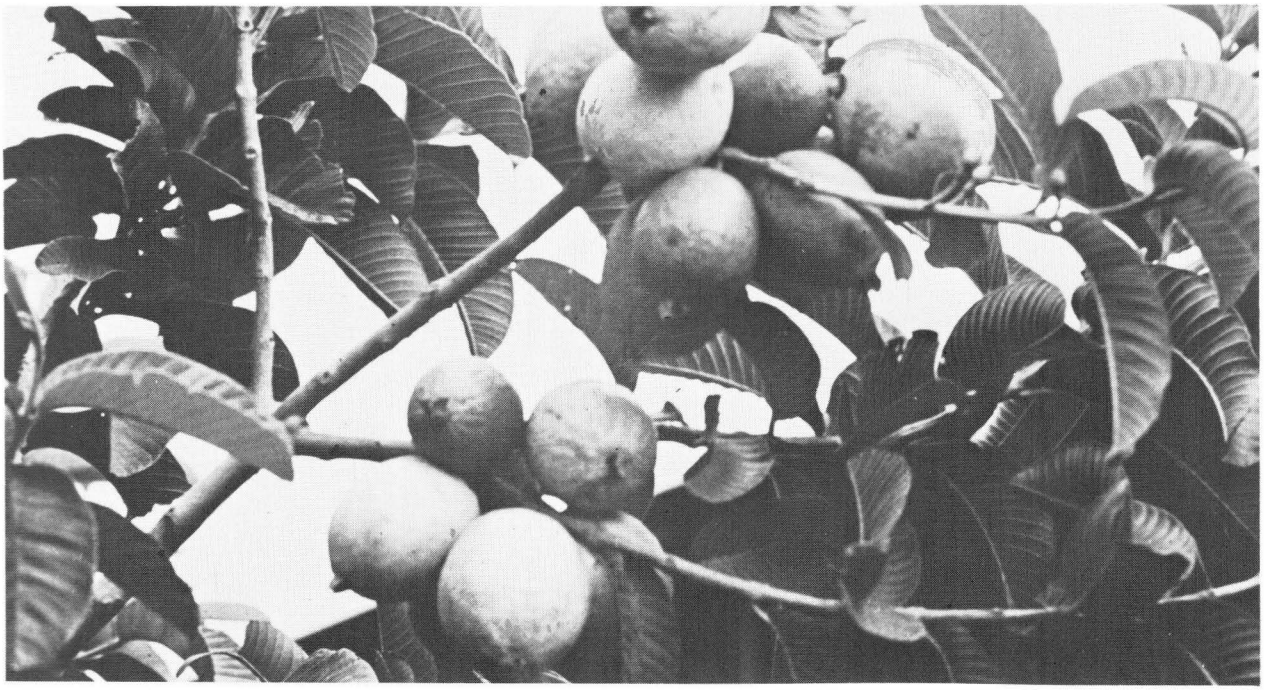
Hawaii was the main supplier of passion fruit between 1955 and 1960, contributing above five-sixths of the State total. Maui, Oahu, and Kauai—generally in that order—were relatively minor suppliers except in 1960, when Maui's area of passion fruit harvested climbed to 130 acres.

Total quantity of fruit harvested for proc-

FIGURE 25



Guava: The new J. H. Beaumont variety, developed by the Hawaii Agricultural Experiment Station, may play an important part in the growth of island guava production. It is an outstanding processing guava. (H. Y. Nakasone.)



essing moved sharply to a peak of 3.3 million pounds in 1956 (1.8 million pounds in 1955) before steadily falling to only 1.1 million pounds in 1960.

Guava

No reliable figures are available on guava orchards. Total harvestings for processing between 1955 and 1960 have ranged between 2.5 million pounds (1955) and 1.7 million pounds (1957), averaging 2.1 million pounds for the 6-year period.

LOCATION, PRODUCTION, AND YIELD OF LIVESTOCK PRODUCTS, 1946–60

Milk

The quantity of milk produced locally, but mostly with imported supplies of feed, cows, and equipment, almost doubled between 1946 and 1960. Milk produced annually in the State (figure 26) rose from 30 million quarts to 54 million quarts. Oahu produced more than four-fifths of these quantities, its proportion of the State's total rising from 80 percent in 1946 to 85 percent in 1960. Each of the other islands produced less than 4 million quarts annually throughout this 15-year period. As Oahu has about four-fifths of the State's population, it is obvious that distribution of milk production in the island chain is, at present, directly related to each island's population. Although land suitable for dairying is scarce and thus expensive on Oahu, very little land is needed, as very intensive methods of land use are employed.

FIGURE 26

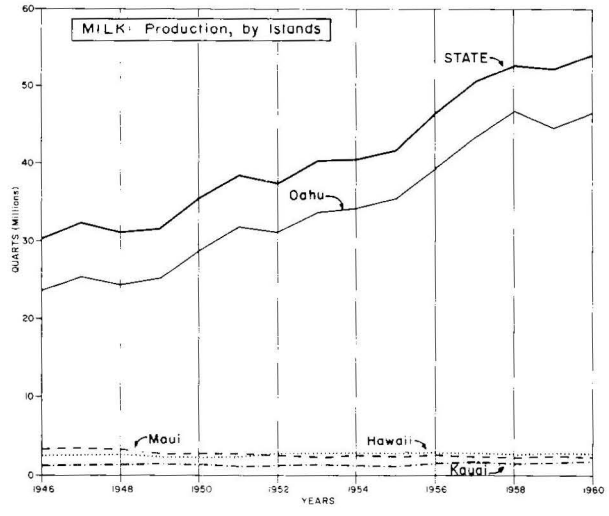
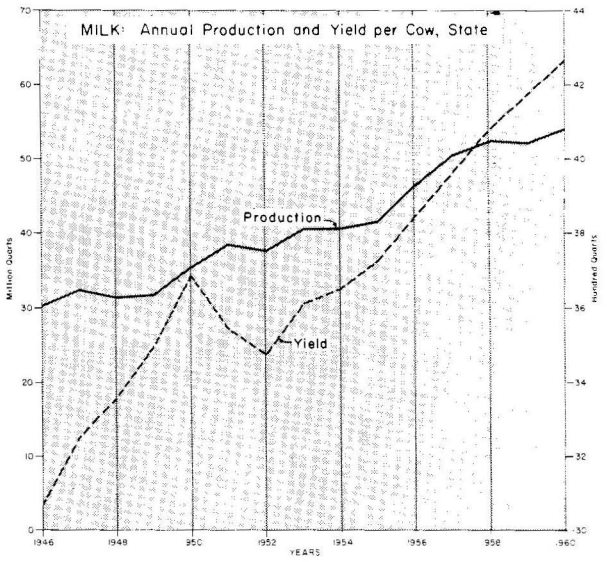


FIGURE 27



Greater supplies of milk (figure 27) resulted from both a substantial improvement in yield per cow (3,060 quarts in 1946; 4,268 quarts in 1960) and in number of cows (10,450 in 1946; 13,430 in 1960).

Eggs and Chickens

State production of both eggs and poultry meat increased fivefold between 1946 and 1960 (figures 28 and 30). Although each of the four islands—Oahu, Hawaii, Maui, and Kauai—engaged in commercial poultry farming shared in this increase, Oahu had by far the lion's share. This island contributed 1.7 million dozen eggs out of the State's total production of 2.2 million dozen in 1946. The corresponding figures for 1960 were 6.4 million dozen out of a grand State total of 10.3 million dozen. In this later year, Oahu egg producers had a smaller share of the State's egg production than in 1946 (62 percent as against 77 percent) but they still had a much greater total output.

As a result of a considerable improvement in the quality of layers, and in their feeding, housing, and management, average annual egg production per layer increased from only

FIGURE 28

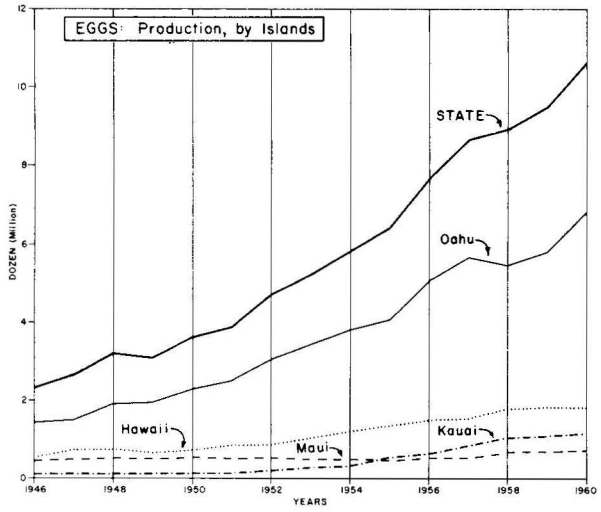


FIGURE 29

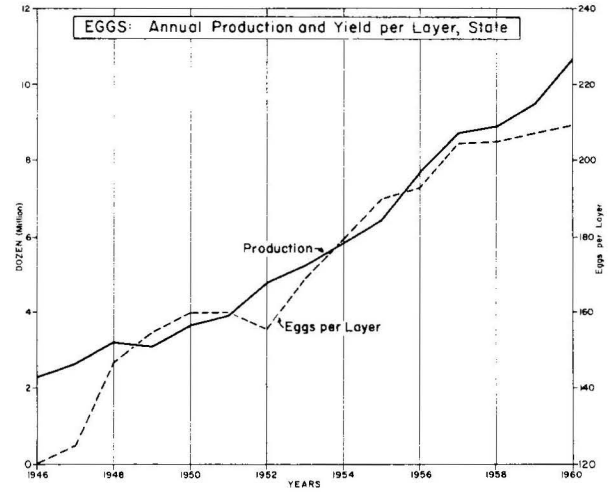
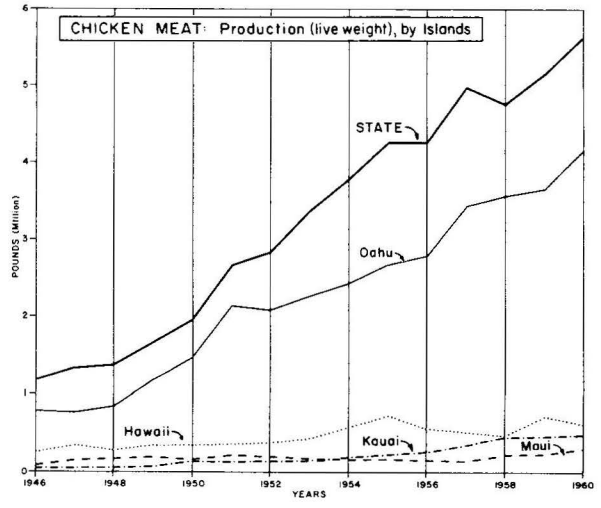


FIGURE 30



120 in 1946 to 210 in 1960, or at the rate of 6 eggs per year. The percentage rise in number of layers during the 15-year period was thus considerably below the percentage change in output (figure 29).

The quantity of chicken meat produced increased at a rate similar to that of egg production. State output rose from 1.2 million pounds live weight (1946) to 5.6 million pounds (1960). A significant change in the type and quality of chicken meat produced locally occurred around 1950. Since then, more attention has been given toward producing lighter-weight birds (2½ to 3 pounds live weight), of better quality, in a shorter time.

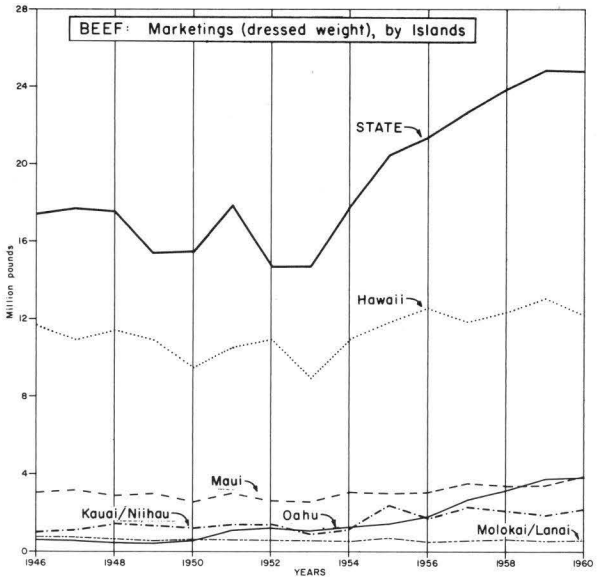
Beef

Several significant trends took place in the island beef industry between 1946 and 1960: a substantial increase occurred in beef production—from 17.5 million pounds (dressed weight) in 1946 to 24.7 million pounds in 1960; about 1954, increasing numbers of grass-fed cattle were finished for market in feeding yards on Oahu; as more cattle were shipped from Neighbor Islands to these feeding yards on Oahu for the final stage of fattening, the stocking capacity of pastures on those islands was increased; and the general quality of island beef improved as a result of better finishing.

Figure 31 shows that the island of Hawaii is the prime island source of beef. It shows that Oahu beef production increased considerably in the 15-year period but this change is somewhat misleading. Most cattle slaughtered on Oahu were either culls from dairy herds or cattle raised on other islands and brought to Oahu for slaughter after 100 days or so in feeding yards.

The gain in beef production after 1954 largely represents increased reliance on imported supplies of feed. Local pastures have not notably increased in area or in productivity since 1954. The increase in the *net* output from the State beef industry is thus much

FIGURE 31



Beef: Cattle on Parker Ranch on the island of Hawaii. Island beef production increased from 17.5 million pounds in 1946 to 24.7 million pounds in 1960. (Hawaii Visitors Bureau.)

less than the production figures shown in figure 31.

Maui's beef production moved slowly up from 3 million pounds (dressed weight) in 1946 to 4 million pounds in 1960, the island retaining second place in order of output. Oahu came up from fourth to third place, just below Maui, in 1960, while production on Kauai and Niihau, together, rose from 1 million pounds (1946) to 2 million pounds (1960). Beef production on Molokai remained very steady at about ½ million pounds throughout the 15-year period.

Pork

In contrast to the exuberant expansion of poultry, dairy, and, to a lesser extent, beef production, island pork production, after suffering a sharp decline between 1946 and 1949, had only climbed back to the 1946 level by 1953 and has remained close to that level since. Island pork differs from other island

livestock products in that it is considered unique by some of the island people. It is a soft pork, garbage-fed, and commands a premium price above grain-fed pork imported from the United States mainland. The data presented in figure 32 suggest that the market for island pork is strictly limited.

Oahu maintained its prime position as a producer of soft island pork. This is a logical result of hog farms being located close to sources of city garbage—and to their main market—the Honolulu metropolitan area. Production on other islands was generally relatively small and mostly for local consumption.

Figure 33 gives some indication that the general level of hog management improved between 1948 and 1960 (relevant 1946–47 data not available). The quantity of live hog marketed per sow-year increased from only around 1,000 pounds in 1948–50 to 1,750 pounds in 1960.

FIGURE 32

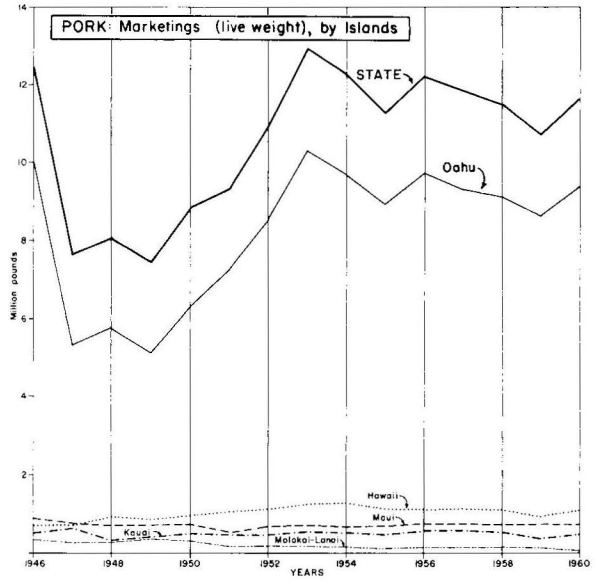
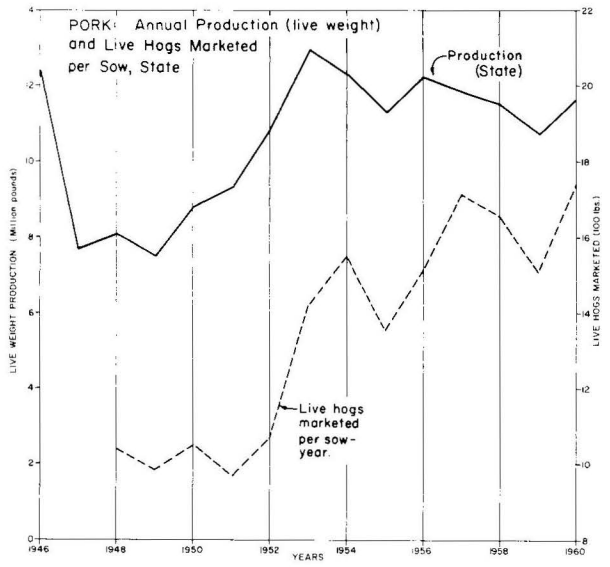


FIGURE 33



Part II. Hawaii's Agriculture in 1975: Projections

PROCEDURES AND ASSUMPTIONS

Projections have to be based on certain reasonably valid assumptions, for it is impossible to know exactly what the future holds. No statistical measure of probability can be attached either to validity of the assumptions used or to the projections—a condition generally expected in other fields of scientific inquiry. No indication is possible of the degree of confidence to be placed in the projections for Hawaii's agriculture, which follow. The procedure adopted does allow us to make the best use of our existing knowledge, however. It enables us to project the extent and the kind of changes to be expected by 1975 by the adoption of "reasonable" but *alternative* assumptions. The prime aim is to make some informed judgments about probable future developments based partly on past relationships, and trends, and, partly on likely future changes. Judgment is inevitably involved.

Adjustments in both the general and the agricultural economy of the State of Hawaii are closely related to general economic changes in the national economy. Producers of some commodities—notably sugar, pineapple, and beef—are also closely influenced by developments in the world economy. In this study the following set of assumptions relating to external economies is used:[1]

1. The United States population will increase to 230 million people by 1975.
2. The U. S. labor force and employment will grow equally with population growth.
3. Labor productivity in the U. S. will rise at about 2½ percent annually.
4. No major wars will occur.
5. Real income per capita will increase about 2½ percent annually between 1960 and 1975.
6. Current trends in popular national consumption habits will continue.
7. Prices in general will remain at about current levels both for the agricultural and for the national economy.
8. Total consumption of farm products in the U. S. will rise between 35 and 40 percent between 1960 and 1975.

The close connection between population growth and expansion in demand for farm products needs little emphasis. Less certain is the influence of rising personal incomes and accompanying changes in tastes on total consumption of farm products. Rising incomes may not greatly expand total consumption per capita but they will almost certainly influence the rate of growth in demand for individual commodities. This observation is particularly relevant to the State of Hawaii, where dietary habits appear to be changing considerably.

The following additional assumptions, with special reference to Hawaii, complete the general framework of assumptions:

1. The State's population will increase to 865,000 by 1975.
2. The number of tourists annually visiting Hawaii will be about 1 million by 1975 (equivalent to 40,000 full-time residents).
3. Employment in the State will grow equally with population.
4. Real income per capita will increase at the projected national rate of 2½ percent annually between 1960 and 1975.

As sugar and pineapple dominate the agricultural scene in Hawaii, these two commodities are discussed first. Then follows a series of projections for the diverse products of other types of farming. These products of Hawaii's "diversified agriculture" may con-

[1]These assumptions are identical with those used in a similar California study: Gerald W. Dean and Chester O. McCorkle, Jr., *Projections Relating to California Agriculture in 1975*, California Agricultural Experiment Station, Giannini Foundation of Agricultural Economics, Mimeo. Report No. 234, July 1960, 110 pp.

veniently be identified into two broad groups. One group consists of commodities produced solely for local consumption—such as milk, beef, pork, and most vegetables. The other group consists of commodities produced entirely or largely for export to the United States mainland and foreign countries—commodities such as coffee and macadamia nuts. Grouping commodities of plantation and nonplantation origin in this way is logically justified by differences in both production and demand conditions.

The separation of plantation and nonplantation agriculture does not imply that no close relationship exists between the two. The analysis which follows should dispel any such opinion. Any relatively small change in the land used, to take only one input, in the island sugar industry, for example, can have important effects on the diversified farming sector though the reverse is not likely to be true.

MAJOR CROPS

Sugar

The importance of sugar to Hawaii needs little emphasis. Hawaii was sugar for many years, then sugar and pineapple. Now these two basic island industries face new, and old, problems of survival. The problems are complex. Their solution in Hawaii's favor depends, as so often, on external factors—favorable federal legislation, increasing costs in competing sugar-producing areas (particularly labor costs), lower unit costs in Hawaii, and favorable local and state laws. Although uncertainty about the future is an important characteristic of the island sugar industry, some projection is possible under certain "reasonable" assumptions.

More sugar—about 25 percent more—will be required by the domestic market by 1975. No shortage of suppliers, or of sugar, is expected then. Current surplus conditions in the world market seem likely to continue. Hawaii is directly concerned as to its share, or quota, in the domestic market. It seems rather futile to forecast in detail what kind of legislation will eventually be enacted to divide this market among domestic and foreign suppliers. However, it seems reasonable to assume that Hawaii will retain its current quota of 1.15 million tons in the immediate future. Further, that this quota may rise to 1.25 million tons as the United States population increases.

This industry's major problems in recent years have not been concerned so much with quota (often not satisfied) but with a low rate of profit, labor and shipping strikes, and continuous attempts to lower unit costs. The high level of technology in Hawaiian sugar which features an intensive type of cultivation—high yields, high investment per worker, and relatively high wages—enables this industry barely to hold its own. Elsewhere, sugar is mainly produced with cheap labor. In Hawaii constant pressure of well-organized workers to share in actual and potential gains from technology and science puts the pressure on management to keep moving. It has become a matter of running even faster to stop going backwards. Ingenuity in developing new strains of cane and new types of machinery (mainly at the Hawaiian Sugar Planters' Association Experiment Station) has tended to keep pace with rising wages (or vice versa) so that labor costs per unit of output have increased slowly or even declined.

It is upon continued technological and scientific developments that existence of this island industry depends. Important changes are expected in methods of harvesting cane, in the extraction of sugar from cane, in moving harvested cane from field to factory, and in irrigation techniques. Current harvesting techniques involve losses of up to 2 tons of sugar (out of 12 tons) per acre with an

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Hawaii's future citizens: The State's multiracial population is expected to be about 865,000 by 1975. (Hawaii Visitors Bureau.)

average loss of 1 ton per acre. The new harvester cutter may cut sugar losses to 2 or 3 percent of total growing yield instead of the 10 to 20 percent now. Extracting sugar from cane by a diffusion process instead of by crushing, as at present, is likely to give a higher rate of extraction at lower running and capital costs.

Another development which may lead to a reduction in the sugar industry's costs is amalgamation of several of the smaller plantations into larger units. This can only be expected to occur when cost studies of the plantation companies involved indicate that such savings would more than compensate for the reduced rate of compliance payments received by large plantations.

Developments of the kind outlined are of two main types—output increasing and cost reducing. Both are obviously closely related.

The projection for island sugar in 1975 is thus more sugar, about 1.25 million tons (150,000 tons more than in 1961), from less land. Sugar land is likely to decline from its present level of 225,000 acres to about 205,000 acres. This change reflects the closing out of marginal plantations, and, urban encroachment on plantations on the island of Oahu.

A primary reason why sugar is expected to be important in the Islands in 1975 is that apart from pineapple it has no serious competitor for large-scale land use. The alternatives are: sugar or rocks, and on the island of Oahu—sugar or houses. The struggle for

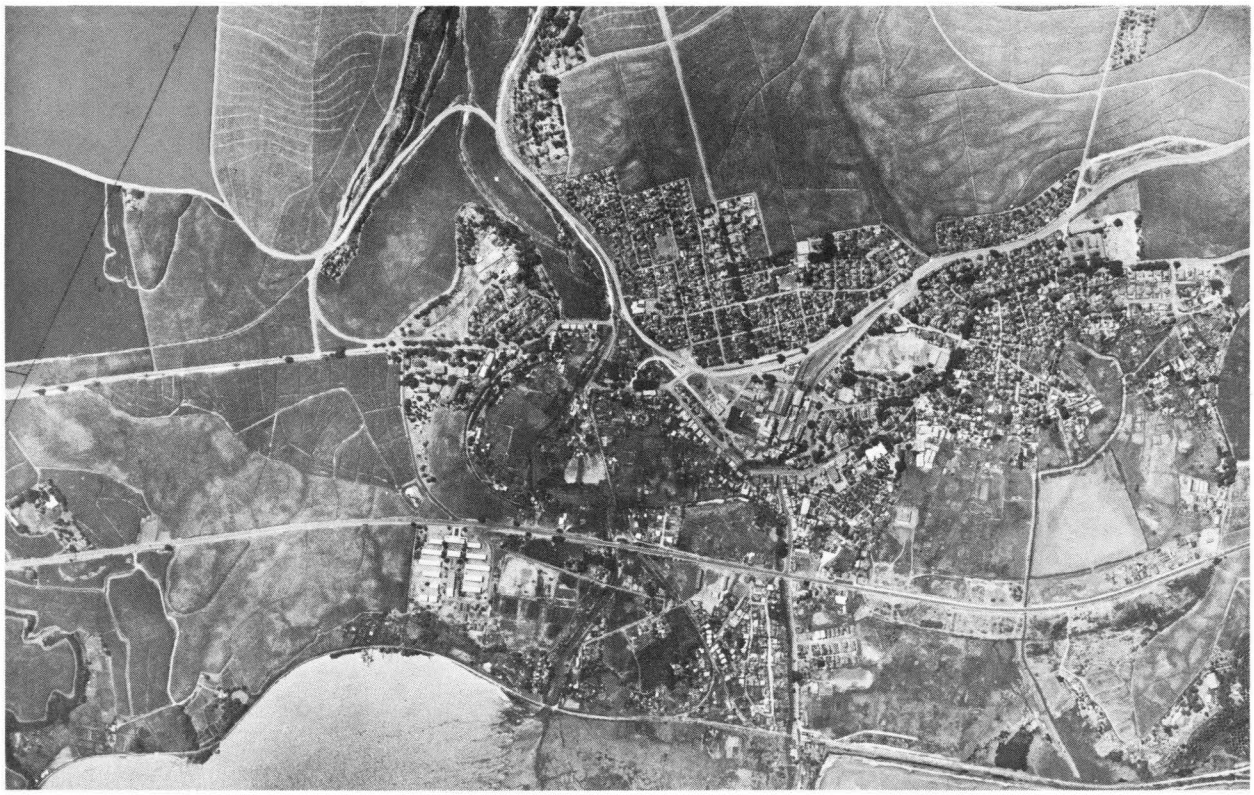
Sugar: Overhead irrigation promises to result in a significant improvement in water utilization. (Hawaiian Sugar Planters' Association.)

survival should bring about its own adjustments. If adjustment is not possible, then decline will hasten as critical decisions whether to maintain the pace of technological change (and heavy investment), or not, are met with a negative answer. Invest in the future of Hawaii, or emigrate, seems to be a critical decision for island sugar and its people, a decision so critically influenced by federal legislation.

Pineapple

The Islands' chief market for pineapple is the United States. This market now takes about 88 percent of total annual sales of Hawaiian canned pineapple, while about 80 percent of canned pineapple annually consumed in the United States comes from Hawaii (table 1). The island pineapple industry faces severe competition in the domestic market from two main sectors: for its solid pack, competition is intense from other canned fruits such as peaches, pears, fruit cocktail, and apples; for its pineapple juice, competition is intense from orange and other citrus juices, grape, and other assorted juices. Future domestic demand for solid pack (canned pineapple) and also for juice (regarded by some pineapple packers as more than a "by-product" of the solid pack), depends upon maintaining, and, perhaps, increasing the annual per capita level of consumption. Demand is expected to rise as

Sugar: The experimental cutter-harvester may eventually lead to a substantial cut in losses (currently about 2 tons of sugar per acre) sustained with present-day harvesting techniques. (Hawaiian Sugar Planters' Association.)



Urban pressure on sugar lands: Cane fields at Waipahu (Oahu) giving way to roads and subdivisions —a 10-year comparison—upper, 1951; lower, 1961. (R. M. Towill Corporation.)

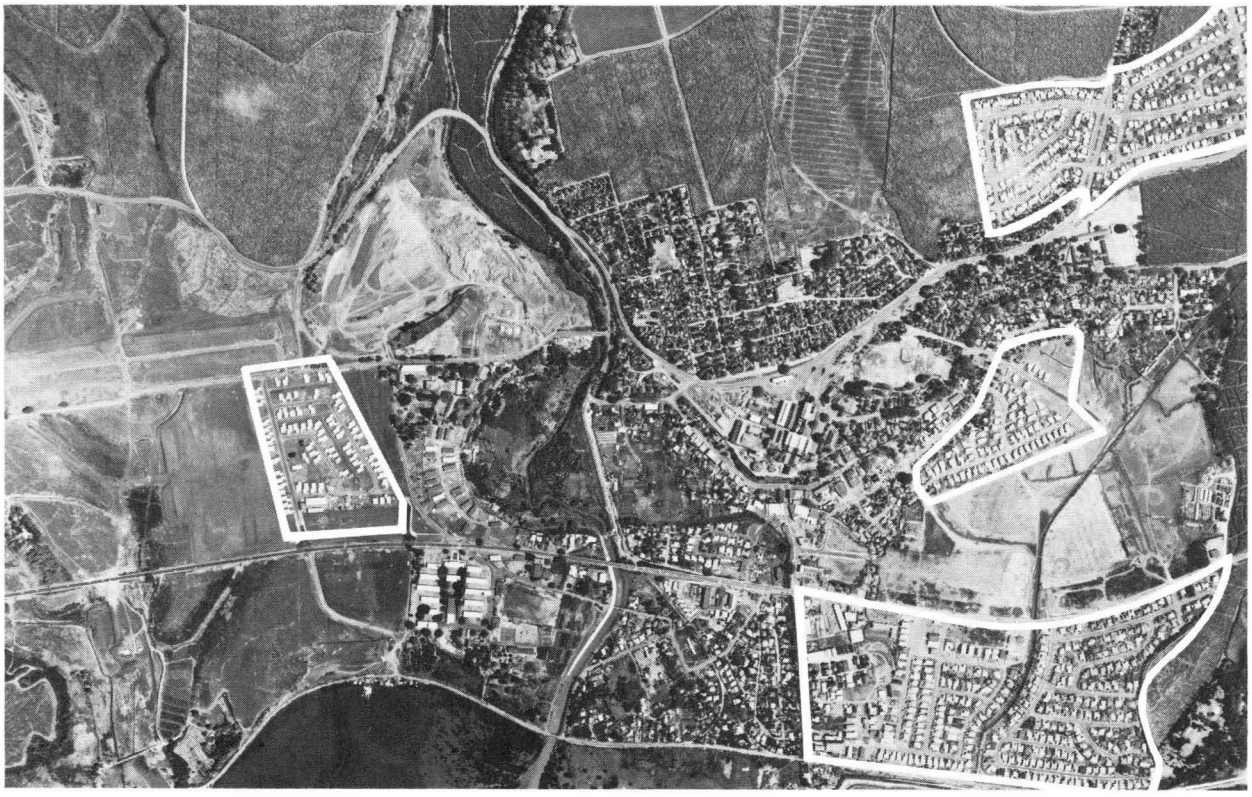


Table 1. United States canned pineapple production and imports, by source, 1950–60. Thousands of cases, basis 24/2½

Year[1]	(1) Hawaiian Pack[2]	(2) U.S. Exports[3]	(3) Hawaiian Pack for U.S. Trade & Govt.[4]	(4) Other Domestic Production Puerto Rico[2]	(5) Other Domestic Production Continental[2]	(6) Imports from Philippines (nondutiable)[3]	(7) Total Dutiable Imports[3]	(8) Total Domestic Production and Imports[6]
1950	11,314	374	10,940	386	400	1,127	765	13,618
1951	10,953	564	10,389	207	250	1,559	704	13,109
1952	12,508	839	11,669	154	300	1,489	542	14,154
1953	12,228	1,090	11,138	98	400	1,798	555	13,980
1954	11,977	1,642	10,335	127	300	723	571	12,056
1955	13,726	1,359	12,367	147	350	945	705	14,514
1956	13,211	2,275	10,936	146	300	1,057[5]	909	13,348
1957	12,220	2,214	10,006	137	300	1,217[5]	1,006	12,666
1958	12,863	2,188	10,675	154	300	873[5]	994	12,996
1959	12,585	1,964	10,621	236	250	1,050[5]	1,018	13,175
1960	13,240	1,624	11,616	201	300	1,040[5]	1,617	14,764

[1]For columns 1 and 3, pack year beginning on June 1 of year indicated. For all other columns, calendar year, except 8, which is a total, combining some pack-year and some calendar-year data.
[2]"Pineapple Hawaii—Basic Facts." Pineapple Companies of Hawaii, Honolulu, 1961.
[3]Compiled by Pineapple Growers Association of Hawaii from U.S. Dept. of Commerce reports.
[4]Column 1 less column 2.
[5]Dutiable beginning Jan. 1, 1956, subject to fractional amounts, increasing annually, of the ordinary customs duty.
[6]Total of columns 3, 4, 5, 6, and 7.

population and real incomes increase. The extent of this change could, however, be relatively small or nonexistent for Hawaiian pineapple if consumers showed a change in preference for other fruits, or foreign pineapple, and price competition worked against the island fruit. It is to counteract some of these unfavorable possibilities that the industry's attention is now being directed towards improving and changing pineapple products.

What has happened recently to the chief factors influencing domestic demand for Hawaiian pineapple? Price competition for solid pack has become more intense from domestic canned fruits and foreign pineapple. Total consumption of canned fruits in the U. S. has risen significantly within recent years. Annual consumption per person rose from 18.2 pounds in 1947 to 22.9 pounds in 1959. Annual consumption of canned pineapple has remained around 3.4 pounds per person since 1947. The proportion of this quantity which was Hawaiian pineapple (1950–60) is indicated in table 1. These are important facts which provide a reasonable basis for projecting future demand for solid pack pineapple.

Under the assumptions outlined in the introduction to Part II of this report, it seems reasonable to assume that annual consumption per person for canned pineapple will remain fairly steady. (It may, of course, rise if efforts to improve and change the various pineapple products are very successful.) Total U. S. demand for canned pineapple in 1975 is thus projected at 17.4 million cases (3.4 pounds per capita $\times$ 230 million)—an increase of 3.5 million cases, or 25.2 percent over the average level for the 2 years, 1959 and 1960.

If it were assumed that demand was to change significantly upwards as a result (say) of improved marketing or downwards

Pineapple: Cross-pollination is the heart of the pineapple industry's program to produce new and better varieties of pineapple. This fruit does not produce seeds normally and must be artificially cross-pollinated. (Pineapple Companies of Hawaii.)

through (say) greater consumer resistance to the relatively high prices of island canned pineapple, this projection would have to be changed upwards or downwards. Prevailing evidence and judgment of some industry leaders suggest, at least, a steady growth in demand as U. S. population grows.

The proportion of total demand for canned pineapple which Hawaii will provide in 1975 is primarily dependent on the future impact of foreign competition in the U. S. market. More competition appears reasonably certain. In 1960 Hawaii supplied 11.6 million cases of solid pack (24 No. 2½, 45-pound equivalent) (78 percent) out of a U. S. total consumption of 14.8 million cases. The proportion of the U. S. total supplied by the Islands has varied from 79 percent (1957, 1960) to 86 percent (1954) since 1950. Table 1 shows the relative importance of shipments from Hawaii, other domestic producers, the Philippines, and other countries to the United States market between 1950 and 1960.

Major competitors for the domestic market are the Philippines, Formosa, Cuba, Mexico, and more recently Malaya, South Africa, and Australia. None of these countries are yet in a position to replace Hawaii as by far the most important pineapple-producing area in the world. Their contribution to the U.S. market is marginal but their impact on Hawaii's pineapple growers is considerable, largely because price competition is intensified. Sudden changes in shipments to the U. S. market from relatively new competitors do not necessarily indicate a continued rapid growth of competition from this direction. Economic and social factors tend to limit this kind of growth. Between 1958 and 1960, for example, shipments of solid pack from Formosa, Malaya, South Africa, and Australia together rose from 12,000 cases to 662,000 cases (106,000 cases in 1959). Part of this increase stemmed from a fall in imports from Cuba, part from the dumping of pineapple on an established market, and some from the natural growth of pineapple industries in these four countries. It is unreasonable to expect growth of imports of foreign pineapple to the U. S. market to continue at this rapid rate. But some growth is to be expected.

If it is assumed that no official attempt is made to interfere with imports of foreign pineapple to protect island growers, then Hawaii's ability to hold its large share of the U. S. market (and its foreign trade) depends on unit cost reduction and new marketing developments (including new and better products).

Competitors such as Malaya and Formosa seem to hold striking advantages in this cost situation. Labor and land are relatively cheap. Latest technology is, or can be made, available. Capital is not scarce. Quality of pineapple is fairly high and improving. Significant cost reduction seems inevitable in future years as cultivation units are enlarged and marketing is coordinated with production. In contrast, Hawaii's pineapple industry has already passed through the various stages of development and appears to have reached (perhaps overreached) the margin of intensive field cultivation.

The critical question is whether more output from Hawaii's industry can be obtained only at rising unit costs while competitors enjoy falling unit costs as output expands. The pineapple industry in Hawaii can have lower unit costs as it maintains or expands output through adoption of higher-yielding varieties of pineapple, and the use of better technology. The impressive range of technology and quality of research employed in this industry are reasons for optimism.

Another major factor determining Hawaii's retention of a large share of the U. S. market is its long-established market development program. This has encouraged strong patterns of loyalty to brand names of pineapple. Ability to withstand foreign competition is closely related to the retention of this pattern of brand loyalty, as it helps to offset any price

Water: More abundant supplies of water are a prime need for the projected expansion in the State's agricultural production through 1975.(Photo Hawaii.)

Table 2. United States exports of canned pineapple to selected areas, 1946–60 (converted to 45-pound cases from pounds)

Calendar year	Canada	West Germany	Sweden	Netherlands	Switzerland	All others	Total
				1,000 cases			
1946	14.6	–	58.2	0.1	48.5	126.1	247.5
1948	22.5	–	0.2	3.2	16.4	200.5	242.8
1950	16.6	4.8	12.4	50.9	62.4	226.6	373.7
1952	374.8	47.6	70.6	60.7	68.9	215.9	838.5
1954	646.4	318.8	151.5	150.4	96.0	279.1	1,642.2
1956	410.0	662.6	174.8	477.1	116.9	433.4	2,274.8
1958	528.5	790.2	175.8	206.0	113.5	373.7	2,187.7
1960	318.2	470.6	108.9	243.7	127.3	355.2	1,623.9

Source: U. S. Department of Commerce.

disadvantage of this Hawaiian fruit. It is significant that more emphasis at the Pineapple Research Institute (maintained cooperatively by Hawaii's seven pineapple companies, established in 1923) is now to be given to research in processing and in developing new products. More attention is to be given to such studies as "consumer acceptance of different pineapple packs, grades and products, including new or low cost items, and pack simplification" and "factors affecting standards and grades of pineapple products."[2]

The oligopolistic nature (small number of large firms) of the island pineapple industry has inevitably fostered an element of secrecy relating to individual firm's production and marketing information. Yields per acre of pineapple have increased by probably 10 percent in the last decade. Within the next 15 years yield increases seem likely to total between 15 and 20 percent. Such increases—from better varieties, better technology, and more abundant water supplies (particularly on the island of Molokai)—are essential if cultivation of pineapple in Hawaii is not to be sharply reduced.

More pineapple will not necessarily require a large rise in investment in new canneries although existing equipment will, of course, have to be renewed and improved from time to time. Existing facilities are adequate to handle a considerably larger volume, especially if the harvesting period can be lengthened. However, new equipment will be needed if the projected new pineapple products come along successfully.

Hawaii's foreign trade in pineapple (table 2) in future years is not easy to project. The impact of the Common Market in Europe on exports of American farm produce is, generally, difficult to foretell. The State's share of the total trade in pineapple will inevitably fall as output from such countries as Formosa, Australia, and South Africa rises. At present, impact from pineapple production in newer areas has hit Hawaii's traditional markets (notably West Germany). It seems probable, however, that future attention will gradually turn towards development of new markets. The bulk of canned pineapple is consumed in North America and Western Europe. Consumption is closely related to relatively high standards of living. Rising incomes which are confidently projected for people in Western, Southern, and Southeast Europe and in Japan are a basis for the widening of the world market in pineapple.

Thus competition for Hawaii in the world market seems likely to be relatively tougher in the years immediately ahead than 10 or 15 years ahead.

[2] *Pine Review*, Vol. 2, No. 2, September 1961, Hawaii.

The demand projection for canned pineapple from Hawaii in 1975 is as follows:

	Million cases
U. S. market	13.0
Foreign market	2.0
Total requirements	15.0

Canned pineapple production in Hawaii is thus projected 20 percent above the current level for 1975. This projection is based on the assumption that Hawaii will contribute 2.0 million cases, or 57 percent, of the extra 3.5 million cases of solid pack required for the domestic market and that it will hold exports at about 2 million cases annually.

More production will come mostly from more intensive use of existing land in pineapple rather than an extension of cultivation. Land scarcity, urban growth, and production economics influence this development. More abundant water supplies on the island of Molokai (from the Federal-State financed irrigation project) may lead to more land in pineapple there and higher production on existing plantations. Higher yields are likely to provide most of the extra pineapple needed.

Attention has been focused on canned, or solid pack, pineapple because the quantity of pineapple marketed in this way largely determines acreage and production of this crop. Juice is generally considered a by-product but a very important one, while pineapple bran and silage for island livestock are by-products with great potential significance. Fresh pineapple is shipped to the U. S. mainland and Canada at an annual rate of about 16 million pounds. The trend is for these shipments to rise (only 12 million pounds in 1956). But such growth must overcome the postwar trend of American consumers away from fresh to processed fruit. Technological improvements to retain the "fresh" quality of pineapple could, of course, lead to a significant change in the outlook for this fruit.

It has to be admitted that long-run prospects for the island pineapple industry are not too clear. So many interrelated factors influence its future. But, as with the island sugar industry, adjustments lie ahead which if tackled successfully may well achieve the projected change outlined for it. If labor difficulties, taxation problems, or a drastic change in the world pineapple situation were to impair further Hawaii's competitive position, then the industry would, of course, slowly decline.

Coffee

The fate of the Kona coffee industry between now and 1975 is not too difficult to project. Present difficulties associated with coffee growing (low and unstable coffee prices, world coffee surpluses, and low hourly earnings) seem likely to persist and, most probably, at a greater rather than a lesser intensity. Even though Kona coffee has the distinction of being a "mild" coffee (a type used primarily as a flavoring constituent), local coffee prices are largely determined by the world coffee situation, for less than 1 percent of the world's supply of coffee comes from Hawaii.

Certainly, better cultural methods and improved marketing (especially through integrating processing and merchandising a "name product") may improve the chances of *survival* for those hardy coffee growers who have withstood the ups and downs typical of Kona coffee growing.[3] Already yields are about 10 times the world average level but this comparative advantage is largely offset by high labor costs. The future is, undoubtedly, one of struggle for existence rather than of exuberant expansion.

Americans will drink more coffee in 1975 because there will be many more millions of them. Coffee will be available for them in abundant quantities. Already it requires an enormous international effort to keep the

[3]See C. W. Peters and John L. Rasmussen, *Integrating Hawaiian Agriculture Through Cooperatives*, Hawaii Agricultural Experiment Station, Agricultural Economics Report No. 57, December 1961, pp. 20–27.

existing coffee surplus within reasonable bounds. Kona coffee could be in a relatively favorable situation in 1975 if the general quality of instant (soluble) coffee had much improved by then. Currently, instant coffee is mostly made from inferior-quality coffees—notably the African *Robusta*–because processing techniques do not enable the finer flavors of better-quality coffees (Kona, for example) to be transmitted into the "instant" drink. If such techniques improved, demand for a "mild" Kona coffee might be expected to increase. But other mild coffees—notably Guatemalan—could be used in place of Kona.

Greater demand for Kona coffee in the Islands appears to offer the main hope for survival of this industry. Relatively small quantities of Kona coffee are consumed locally at the present time. Preliminary results of a market survey being carried out to determine the potential demand for Kona coffee in the Islands underline the need for radical improvements in merchandising and in quality control. Experience indicates that good substitutes do exist for Kona coffee in the world market, hence the current unhappy predicament of local coffee growers. It seems logical to develop a strong position in the local market.

Coffee farms which are expected to survive unfavorable economic conditions likely to be met between now and 1975 are the small farms (about 6 acres), run solely by family labor and located in the better growing areas of the Kona coastal strip. Such farms are not easy to mechanize because of their difficult terrain, so that unit labor requirements have not fallen in recent years as they have for most other farm commodities. Larger farms generally located on less favorable land and operated with some hired labor are expected to be retired from coffee growing (as happens periodically in the boom-slump cycle typical of Kona coffee farming). Greater intensity of land use by intercropping and, possibly, by diversifying with macadamia nut trees, is likely to improve survival chances of Kona coffee farms.

The coffee-bearing area in Kona is projected at between 3,000 and 3,500 acres for 1975. This is some 1,500 to 2,000 acres below the 1961 level but equal roughly to the combined areas of coffee farms with a proven high survival value.

Macadamia Nuts

The upward trends in the bearing and nonbearing areas of macadamia nut orchards are a significant feature of the preceding analysis of trends in Hawaiian agriculture. The prevailing opinion among growers of this delectable nut is that a great expansion in its local importance can confidently be predicted. It is equally suitable for production in large-scale specialized units, or on small farms. It is a useful means of intensifying land use and of diversifying production. Paradoxically, an increase in the area of macadamia nut orchards need not result in any decline in sugar or pineapple land. The nut tree thrives on rocky, lava soils not generally suited to these two crops and it can be planted successfully in comparatively difficult terrain.

As with any new commodity, critical problems concern costs of production, methods of marketing, and the development of a receptive market. The macadamia nut industry in the Islands is still relatively new. Collection of relevant cost and marketing data thus far has tended to show that between 2,000 and 3,000 acres of macadamia nuts can be grown successfully in the State for a high-priced gourmet market on the United States mainland.

Extensive marketing research has also suggested[4] that profitable and significant growth of this island industry depends mainly on its leaving the very limited gourmet market and entering competition with the common peanut, cashew nut, and other ordinary grocery

[4]Frank S. Scott, Jr., *Characteristics of Consumer Demand for Macadamia Nuts*, Hawaii Agricultural Experiment Station, Agricultural Economics Bulletin 16, October 1958, 38 pp.

lines. Potential demand in this wider market is projected at much higher levels.

This change would be logical: it is projected to occur. No close estimate of likely demand for this "new" commodity is possible for 1975. There is no firm basis on which to base a projection, for, until now, few Americans have yet tasted a macadamia nut!

However, the relatively slow nature of the growth of macadamia nut trees suggests that the maximum bearing acreage in 1975 is not likely to be above 15,000 acres. It is also not likely to be less than 7,000 acres. Yields per acre may be considerably above current levels (very changeable, so far) by then as a result of improvements in stock, cultural methods, and other advances. The main location of macadamia nut production is unlikely to shift from the island of Hawaii.

Rice

No rice production is projected for the State of Hawaii in 1975. The marked downward trend in both rice acreage and in the number of rice growers reflects the powerful impact of competing mochi rice grown mainly in California (inshipments from the U. S. mainland rose from 150,000 pounds in 1956 to 500,000 pounds in 1960). Another important contributing factor is the lack of enthusiasm of younger workers to continue the back-breaking handwork involved in local production practices (see photograph). Survival would appear possible only if local rice growers were prepared to accept unduly low incomes to remain at their business. Prevailing trends indicate that they are not willing to do this and one would not expect it. The small local scale of operation does not enable Kauai growers of rice to achieve the economies of large-scale rice production enjoyed by California growers. Even if local rice growing were organized as a closely-knit, cooperative, integrated venture, it seems very unlikely that it could overcome its relatively great weaknesses.

Taro

A continued slow decline is projected for the production of taro—the root from which "poi," a traditional Hawaiian style food, is obtained. Higher yields—up some 10 or 15 percent—will, to some extent, offset the reduction in taro acreage. The island demand for taro is likely to drop by 1975 in spite of the projected population increase because of changing dietary habits. A potential demand for taro on the United States mainland as an ingredient in baby foods has stimulated some local hopes for this commodity.[5] But the scale and methods of producing taro in the Islands are not amenable to the specific requirements of the United States baby food market—tantalizing as the prospect may be. Labor requirements of taro growing are high, the work is not attractive, and, in addition, suitable land for taro production is rare and becoming even more so.

Vegetables and Melon

It has already been shown that output of vegetables in the Islands has remained at about 48 million pounds, annually, from a steadily declining acreage (5,710 in 1946; 3,440 in 1960). The composition of the vegetable assortment locally grown has not changed much within recent years. Almost all production is for local consumption. Relatively small quantities of fresh island vegetables are purchased by the military forces stationed in the Islands. So far, only relatively small quantities of some exotic-sounding products, such as ginger root, lotus root, dasheen, and yam bean root have been shipped to the U. S. mainland. Yet hopes tend to persist for the development of a winter market for island vegetables (specifically in snap beans, cucumbers, eggplant, bell peppers, Italian squash, and tomatoes). The difficulties surrounding such trade have

[5]See Virginia Derstine and Edward L. Rada, *Some Dietetic Factors Influencing the Market for Poi in Hawaii*, Hawaii Agricultural Experiment Station, Agricultural Economics Bulletin 3, July 1952, 43 pp.

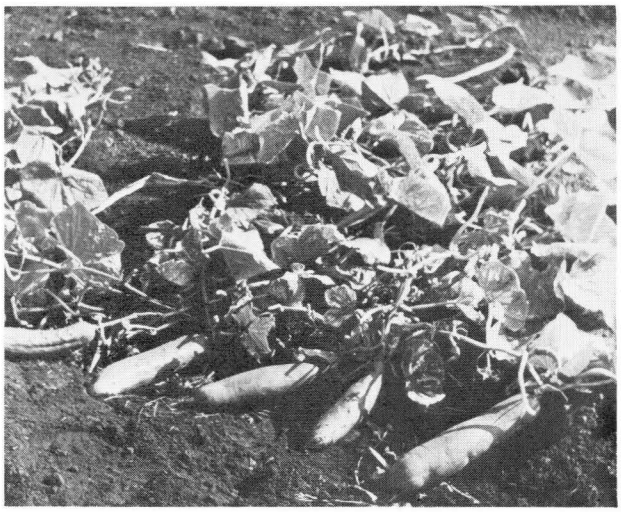
Supermarkets: The trend towards precooked, packaged, and processed foods has created a revolution in methods of mass merchandising. Small farmers in the Islands need to cooperate to meet requirements of these new conditions. (Camera Hawaii.)

been carefully examined[6] and the conclusion reached that all depends on the question, "Can local costs be significantly lowered?" Relatively high land, labor, and water costs make the task of trade development very difficult. Other problems relate to the need for better local methods of cultivation and harvesting, improved seed strains, better herbicides, and less stringent shipping requirements (current fumigation procedures required for export crops damage quality and reduce shelf life of several vegetables).

At this point in time it is possible to state that a potentially worthwhile market exists for Hawaiian winter vegetables only if problems so long unsolved are overcome. The Molokai Demonstration Farm, established in 1959 to determine what crops will grow on the island of Molokai and at what cost, is a public action to overcome some of these difficulties. If such a trade in vegetables were developed, production would tend to be concentrated on the islands of Molokai and Hawaii, where newly irrigated land provides suitable growing conditions.

Local demand for fresh island vegetables is not projected to keep pace with the pro-

[6]C. W. Peters, J. A. Mollett, and Woodrow Y. Nakashima, *Mainland Markets for Hawaiian Winter Vegetables*, Hawaii Agricultural Experiment Station, Agricultural Economics Report No. 51, June 1961, 12 pp.



Cucumbers: The first crop of cucumbers from virgin land on the Molokai Demonstration Farm. Cucumbers together with snap beans, eggplant, bell peppers, Italian squash, and tomatoes have large potential winter markets on the West Coast. But major problems have to be overcome before "potential" becomes actual. (Douglas J. McConnell.)

jected rise in State population even though it is reasonable to assume that the military may purchase more local vegetables. Improved ocean freight, diminished importance of the local vegetable market as a result of direct bulk buying by supermarkets from large mainland vegetable growers or dealers,[7] and increasing importance of canned, frozen, dried, and other processed vegetables are the chief factors influencing this situation. Another factor which always exerts a depressing effect on local vegetable production is the "pocket market" situation in the Islands which introduces the strong element of risk of "overproduction" and, consequently, of low prices.

As relative increases during the next 15 years in the yields of the different vegetables grown locally are likely to differ, as well as demand for such vegetables, no attempt is made to project the relative importance of particular vegetables in 1975. Most significant gains in yield can be expected from green onions (15 to 20 percent), green corn (10 percent), head cabbage (10 percent), tomatoes (20 percent), sweet peppers (10 percent), and cucumbers (10 to 15 percent). In general, yields per acre of vegetables are likely to rise (by 10 to 15 percent) as a result of better growing methods and improved varieties.

Thus the area under vegetables for local consumption in 1975 is projected at only 10 percent above current levels, or at about 3,800 acres. If the market for winter vegetables were successfully established, the whole situation would radically change. But this is a matter beyond the scope of this limited study.

Fruits

Papaya. Papaya production more than doubled in the 1950's, from about 6 million pounds (1950–51) to about 13 million pounds (1959–60). This trend was in keeping with the locally-held belief that papaya offered a great opportunity for diversified farming. This hoped-for expansion was to come mainly from development of the poten-

Interisland communications: A new harbor at Kawaihae (Hawaii), an important link in the State's water traffic system. (Photo Hawaii.)

[7] C. W. Peters and John L. Rasmussen, *Some Recent Developments in the Marketing of Foods in Hawaii*, Hawaii Agricultural Experiment Station, Agricultural Economics Report No. 60, June 1962, 28 pp.

tially vast U. S. mainland market for fresh papaya, canned papaya nectar, nectar base, and frozen and chilled nectar. Market development studies carried out by Ralph Elliott and C. W. Peters[8] of the Hawaii Agricultural Experiment Station suggested a promising future for growth of papaya exports in one form or another.

Growth in exports of fresh papaya to the U. S. mainland has, however, fallen far short of the high expectations originally held. A major factor restricting growth in the fresh trade has been the relatively short keeping qualities or "shelf-life" of papaya. A considerable amount of research work into the biochemical factors influencing shelf-life, not only of papaya, but of other tropical fruits, is being carried out at the University of Hawaii. New methods of radically improving the keeping qualities of papaya may well become available within the next few years. Such an innovation could lead to a relatively rapid rise in fresh papaya shipments to the U. S. mainland. Some indication of the possibilities of this trade may be gauged from the current relatively rapid growth in air shipments of fresh papaya to selected California cities.

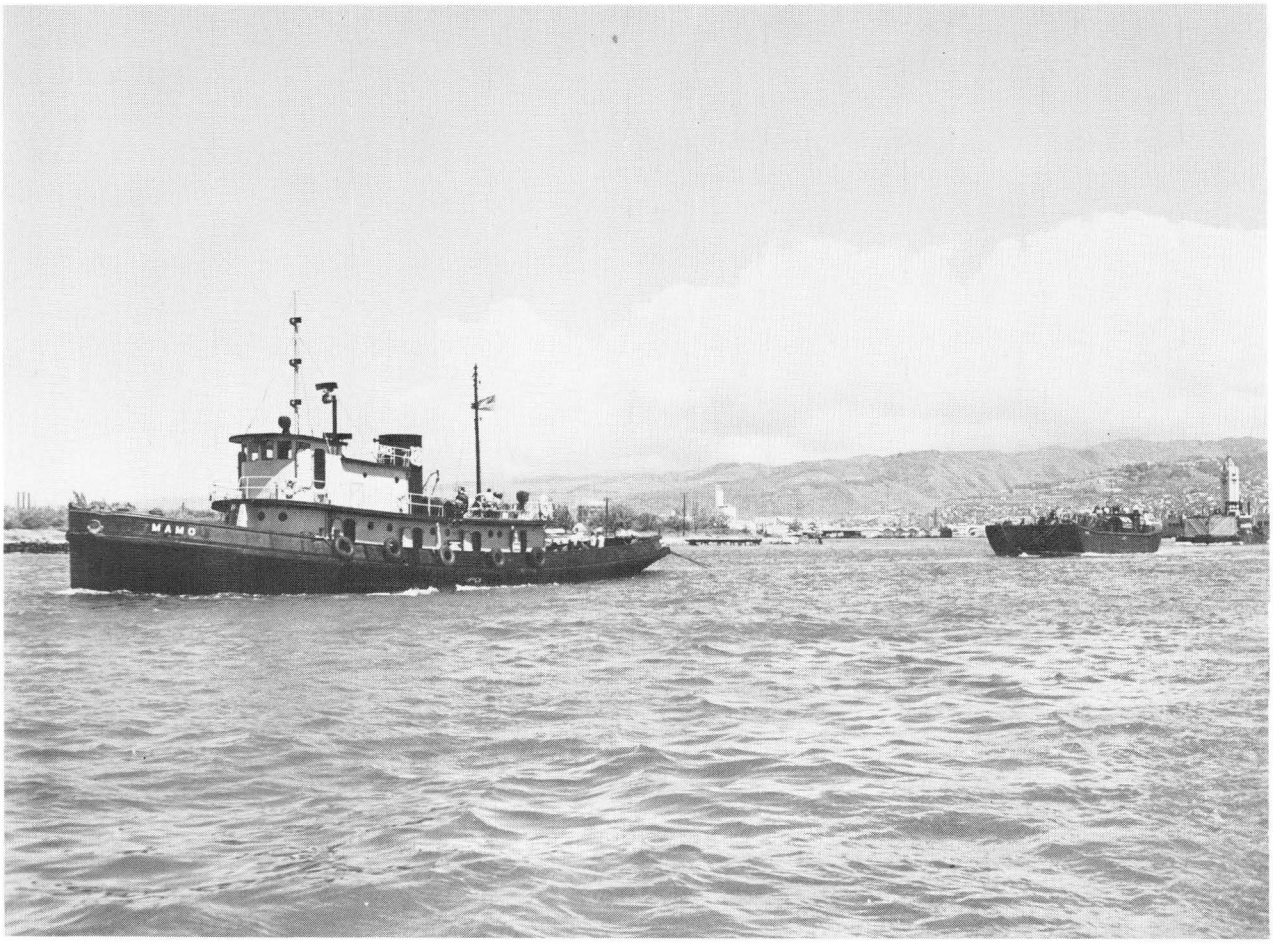
Growth in island demand for fresh papaya may confidently be expected to keep pace, at least, with increases in island population.

Demand for processed papaya has not significantly changed in the U. S. market within recent years. Yet Elliott's market

[8]Ralph Elliott, *Prospects for Marketing Hawaiian Papaya Products in the United States*, Hawaii Agricultural Experiment Station, Agr. Econ. Bull. 1, June 1950, 94 pp.

C. W. Peters, *Marketing Fresh Hawaiian Papayas and Pineapple on the Mainland*, Hawaii Agricultural Experiment Station, Agr. Econ. Bull. 6, September 1953, 31 pp.

Interisland communications: The barge train leaving Honolulu harbor for Hilo. Better interisland freight services are imperative. (Photo Hawaii.)



development study does indicate that a potentially significant market exists. Expansion of trade in fresh papaya would tend to give a firmer basis for development of the processing side of papaya production.

Taking all these various imponderable factors into account, it seems best to limit a projection of papaya acreage in 1975 to only the minimum area of 1,200 acres and about 24 million pounds of fruit. The maximum area depends to a great extent on unknown market developments, unforeseen production difficulties, scientific advances to improve the fruit's keeping qualities, and effective control measures over virus diseases currently creating control problems with established orchards.

Papaya production already centered on the island of Hawaii may eventually achieve the status of a major industry there.

Bananas. Island demand is the basic factor determining the production of the several varieties of bananas grown in the State of Hawaii. The exporting of bananas to the U. S. mainland ceased just after World War II ended, primarily the result of fruit fly infestation indirectly caused by that war (plant quarantine regulations were obviously difficult to enforce effectively then). No new development of an export trade in bananas is projected nor is any significant change in island per capita banana consumption, which in recent years has been slowly declining.

Total production (for 1975) is projected at 30 percent above current levels, or at about 9 million pounds, annually. Yield improvements as a result of better varieties, heavy fertilizer applications, and better methods of cultivation are projected at 15 percent above current levels. Thus the 1975 banana acreage is projected at 13 to 15 percent above the 1960 figure, or at about 950 acres. The gain in acreage is likely to occur mostly on the islands of Hawaii and Kauai. These islands are currently gaining as land is retired from banana growing on the island of Oahu.

Avocado. Production of island-grown avocados has been exceptionally stable, at about 1 million pounds annually in the last 15 years, much of it from backyard-type plantings. Local demand has not changed in keeping with the rise in the State's population. Acreage in avocado orchards has been about 200 acres since 1954.

No marked change in this situation is projected for 1975 as far as the area of avocado orchards is concerned. Yield gains projected at between 10 to 15 percent are expected to provide extra production required by a projected change in demand arising mainly from the increase in island population and also from changing dietary habits. Shipments of avocado to the U. S. mainland are not permitted at present. The future development of an export trade in this commodity depends to a large extent on solving problems associated with quarantine regulations.

Tangerines and Oranges. In spite of all the apparently cogent reasons frequently advanced[9] for an expansion of the island citrus industry (including limes and lemons) currently producing about 1 million pounds of fruit annually, it is significant that no such hoped-for growth took place in the 1950's. It is not projected to occur by 1975.

The growing of tangerines and oranges in the Islands is handicapped not only by economic factors—the small scale of production, intense competition from large, established citrus growers in California, Florida, and Texas—but also by the physical problems. Few, if any, areas in the State are ideally suited to citrus production, not due to lack of warmth, or suitable soils, sunlight, water, or disease-incidence, but to the small variation in temperatures between day and night (diurnal temperature change). A relatively large temperature change (from positive to

[9]See a typical report: Ethel Chong and Andrew Gerakas, *Citrus Potential in Hawaii*, Economic Planning and Coordination Authority Staff Report No. 18, Territory of Hawaii, October 1958, 13 pp.

negative) is essential if color, acidity, and sweetness of the citrus fruits are to reach optimum levels. In contrast to oranges grown in Mediterranean countries, California, and Florida, island-grown oranges are generally lacking in color and acidity. Although some island oranges are sweet, they lack the astringent flavor one normally expects in a citrus fruit.

Improvement in local methods of production and marketing are likely to maintain the survival power of existing citrus producers but no significant change in the area in tangerines and oranges is projected for 1975.

Guava and Passion Fruit. Both guava and passion fruit are sold only in the processed form as puree, juice, and nectar base (frozen or chilled). Frank S. Scott's marketing studies[10] suggest that the potential U. S. demand for guava and passion fruit in one form or another may be considerable if sufficient attention is given to market development.

It may be that commercial orchards of both guava (currently picked in the wild state) and passion fruit will become a prominent feature of the Islands by 1975. The rather hesitant trends of the past 15 years do not necessarily portray future conditions but competition is intense in the fruit juice market.

FLORAL PRODUCTS

During the 1950's the local floral products industry did not show any marked trends in total output (about 500,000 packages shipped to the Mainland annually). Some significant shifts did occur among the types of product and in the method of sale. Shipments to the mainland United States tended toward greater emphasis on the gift package. This was a direct outgrowth of the rapid development of the tourist business and the stationing of additional military people in the Islands. Also, the commercial exports of floral products moved more toward the heavier types of cut flowers and cut foliage. Orchid shipments, except plants, significantly fell due to the decline of mainland interest in the vanda Joaquim as a promotional item while the anthurium, ti leaf, and wood rose gained in trade acceptance. A considerable increase occurred in the 15-year period in sales of orchid plants to buyers all over the world. Sales of flowers for local use were and are stable from year to year.

According to the 1959 Census of Agriculture, cultivated floral products sold by Hawaii producers were valued at almost $2 million. In light of the anticipated increases in tourist business and in local population, coupled with some further development of commercial shipments to the Mainland, it is probable that this industry may show a 50 percent gain by 1975. Hawaii's people use flowers extensively but this practice cannot be expected to exert more than a moderate growth influence on the industry at large. Increased sales through commercial channels and in the gift package trade will depend in part on the type of market development program, if any, that is conducted by the growers and dealers. Up to the present the industry has not waged any intensive or organized campaign to promote the sale of Hawaii's tropical floral products either at home or on the Mainland.

In the growing of floral products there will undoubtedly continue to be many part-time growers who use this enterprise both as a hobby and as a source of supplemental income. It is highly probable, however, that some dealers will seek to obtain further control of their sources of supply in order to be assured of a more continuous flow of flowers and foliage. Establishment of a central flower market in Honolulu has been suggested but

[10]Frank S. Scott, Jr., *An Analysis of Market Development for Frozen Passion Fruit Juice*, HAES Agr. Econ. Bull. 11, June 1958, 39 pp.; *Commercial Uses and Consumer Preferences for Hawaiian Guava Products, A Guide to Market Development*, HAES Agr. Econ. Bull. 13, August 1958, 15 pp.; *An Economic Analysis of the Market for Frozen Guava Nectar Base, Buying Patterns and Potential Sales*, HAES Agr. Econ. Bull. 14, September 1958, 21 pp.; and *Frozen Passion Fruit Juice, An Appraisal of the Mainland Market Potential*, HAES Agr. Econ. Rpt. 25, December 1955, 21 pp.

creation of this facility may become impracticable if a few large-scale growers and dealers reach the point of dominating the floral products trade.

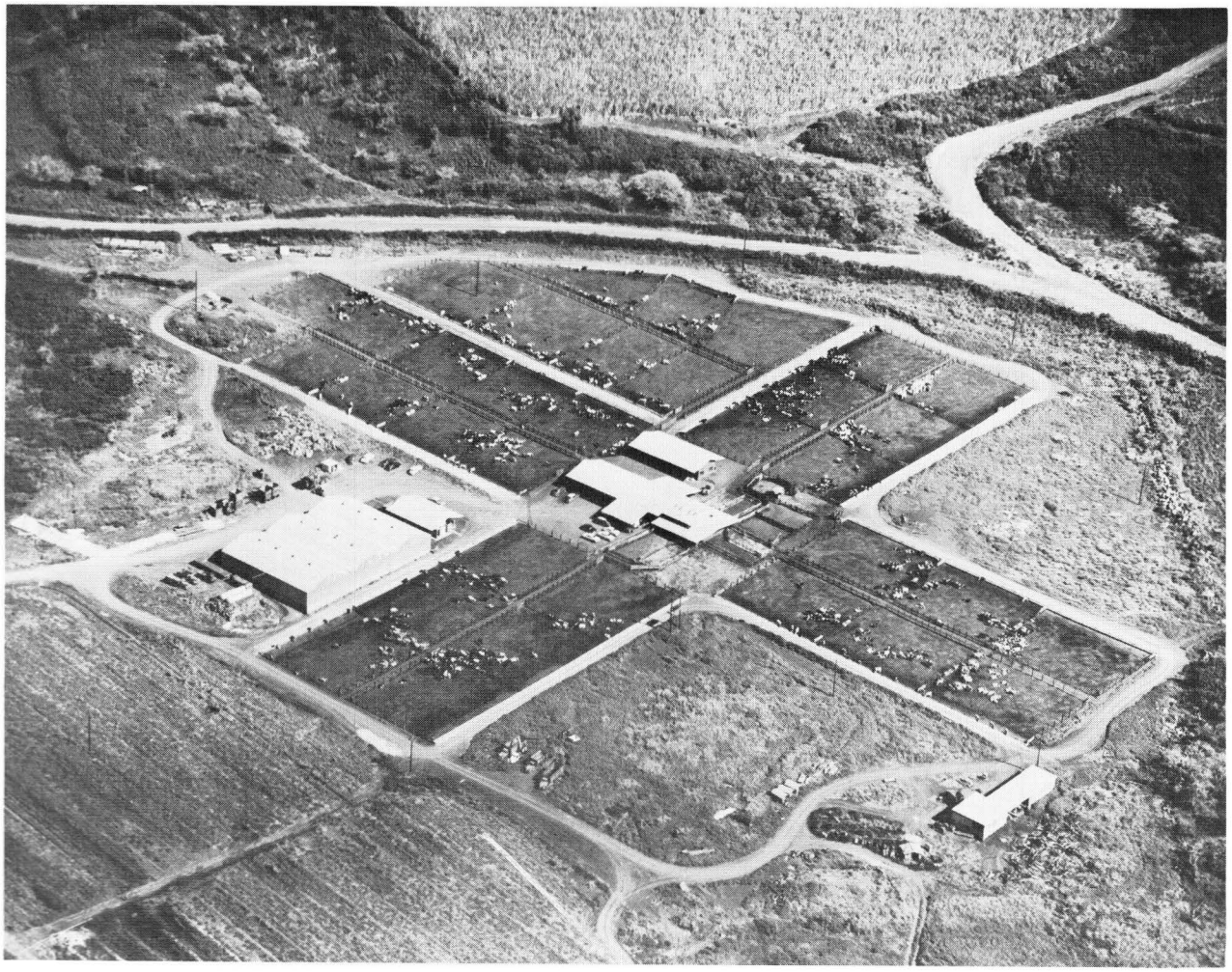
LIVESTOCK PRODUCTS

Milk

Fresh milk consumption in the State in 1975 is projected at about 90 million quarts, or about 70 percent above the 1958–60 level. This change in consumption is based on a population rise of about 40 percent and an increase in per capita milk consumption of about 20 percent. Such an increase in per capita milk consumption would still leave the island figure well below the comparable projected U. S. mainland figure.

Average annual production per cow is projected to increase 15 percent to about 10,500 pounds (4,910 quarts) by 1975. At this production rate, 18,300 cows are required to meet the 1975 demand for fresh milk—an increase of 48 percent above current levels. This projection assumes that the island dairy industry would not have to face undue pressure from new sources of milk such as sterile concentrated milk from Wisconsin and other low-cost milk-producing areas. If trade in concentrated milk was successfully established in the relatively high-cost Honolulu milkshed, it could conceivably lead to a sharp drop in island milk production. Ability to withstand such possible competition revolves around the need to lower production costs by several cents per quart. Substantial cost re-

Island dairying: An aerial view of a 900-cow "dry-lot" dairy on the island of Oahu. Note the small area of land used. (Dairymen's Association.)



duction in island milk production depends basically on much lower feed costs. This might be achieved in several ways: by extensive use of local feeds—mostly by-products of sugar and pineapple production—and a consequent saving on freight costs of feeds currently shipped in from the West Coast; by using cheaper methods of shifting feed supplies from the mainland to island farms; and by employing better feeding techniques designed to obtain optimum "least cost" rations. At this stage, however, it is not certain that the local industries supplying by-product feeds will price them according to the dairy industry's ability to pay.

Abundant quantities of pineapple bran, pineapple silage, and molasses are likely (in future years) to reduce the need for much extra land for dairy cows. Intensive dairying, mostly on Oahu, seems likely to stay. A major shift of dairies to the Neighbor Islands will not occur until better interisland freight services are available. But, more reliance on locally-reared replacements may raise the need for more pasture and alfalfa on the outlying islands. It is projected that more intensive use of pastureland on ranches currently engaged in beef production will provide the extra feed required.

Eggs

Annual per capita egg consumption in the Islands has risen at a rapid rate since 1950 when it was only 140. It averaged 224 in

Island dairying: A close-up view of dry-lot feeding. More reliance on by-products of the sugar and pineapple industries for dry-lot feeding is projected. (Dairymen's Association.)

1958–60. The annual consumption of eggs is projected to rise to 280 per capita by 1975 —still well below the projected U. S. mainland figure of 403 eggs per capita. This projected increase reflects a continuing change in dietary habits, especially towards the general adoption of the western style of breakfast. Total shell egg requirements for the State will thus amount to about 21 million dozen.

If it is assumed that local farmers supply 90 percent of island demand in 1975, then local requirements of fresh eggs will total about 19 million dozen (11 million in 1960). As annual egg production per layer is projected at 250 in 1975 (210 in 1960), the laying flock required then amounts to 910,000 (655,000 in 1960). Improved management and better-quality stock are the primary reasons for the projected rise in eggs laid per hen.

Location of egg production will remain centered on the island of Oahu with intensive production methods on relatively few large units, unless land scarcity or zoning restrictions force a move to Molokai and other outlying islands.

The competitive position of the island egg producer might be expected to improve if cheaper supplies of island-grown feeds become readily available, at favorable prices.

Broilers and Fryers

Broiler production in the Islands expanded considerably in the 1950's (585,000 marketed in 1953; 893,000 in 1959) but by 1960 local broiler meat was only about 30 percent of total broiler sales. Stiff competition from mainland imports is likely to continue to restrict local broiler production to about the 30 percent level. This appears to be the extent of local demand for the currently more expensive "fresh" island chicken.

A considerable rise in per capita chicken meat consumption is, however, projected for 1975 to 25 pounds (eviscerated basis) as compared with 17 pounds in 1960. The 1975 island per capita consumption figure is below the current U. S. mainland figure of 29 pounds. Requirements in 1975 from the local industry are projected at more than double the current level of output at 7.1 million pounds (eviscerated basis).

Any drastic improvement in the island feed supply situation could, however, lead to local farmers supplying double or triple this quantity at the expense of imported mainland birds.

Location of broiler production is expected to remain centered on Oahu.

Beef and Veal

Beef production in the State is important not only for its import-saving value (worth $9.3 million, gross, in 1960) but also for utilizing over 1 million acres of grazing land not very suitable for much else. Island beef consumption is projected to increase about 80 percent above the 1958–60 level but it is difficult to project what share of the expanded market will be in local hands. Beef and veal marketed in 1975 is projected at 77 million pounds, dressed weight (including dairy cattle), or some 34 million pounds above the 1958–60 level. The projected 1975 per capita consumption figure of about 85 pounds is close to the current per capita beef consumption level on the U. S. mainland.

How much of the 1975 beef marketings is produced in the Islands is to some extent outside local control—the intensity of foreign (especially New Zealand) and U. S. mainland competition, the change in quality of meat demanded. Radical improvements in production methods and management could, undoubtedly, strengthen the position of island ranchers in this competition. Gains in economy can be expected from several factors: the improvement of range feeding by determining whether particular pastures suffer from mineral imbalance, analyzing their

nutritive content (something like crop logging used in the island sugar industry), and supplementary feeding on the range, together with fertilizer application to remedy any deficiencies; increased use of feedlot operations on the islands where cattle are reared—Hawaii, Molokai, and Maui—to make available more grazing land for young stock; long-term improvements in quality of island stock; the lowering of feed costs by improving a limited area of grazing (instead of using the current costly extensive grazing methods), and by adding more local feeds such as pineapple hay or silage and molasses to the supplementary rations.

As island ranchers face up to their present competitive difficulties, it is projected that with greater use of the kind of improvements outlined, local beef marketings will be about 50 percent higher in 1975 than now. This means annual marketings will be about 36 million pounds (dressed). It is projected that less land will be used to obtain this greater quantity of beef than is presently in rangeland. A much better job of production will be done on fewer acres as more intensive methods of feeding, grazing, and breeding are adopted. Local feeds, by-products of the sugar and pineapple industries, will release rangeland currently used for finishing cattle.

Fresh Pork

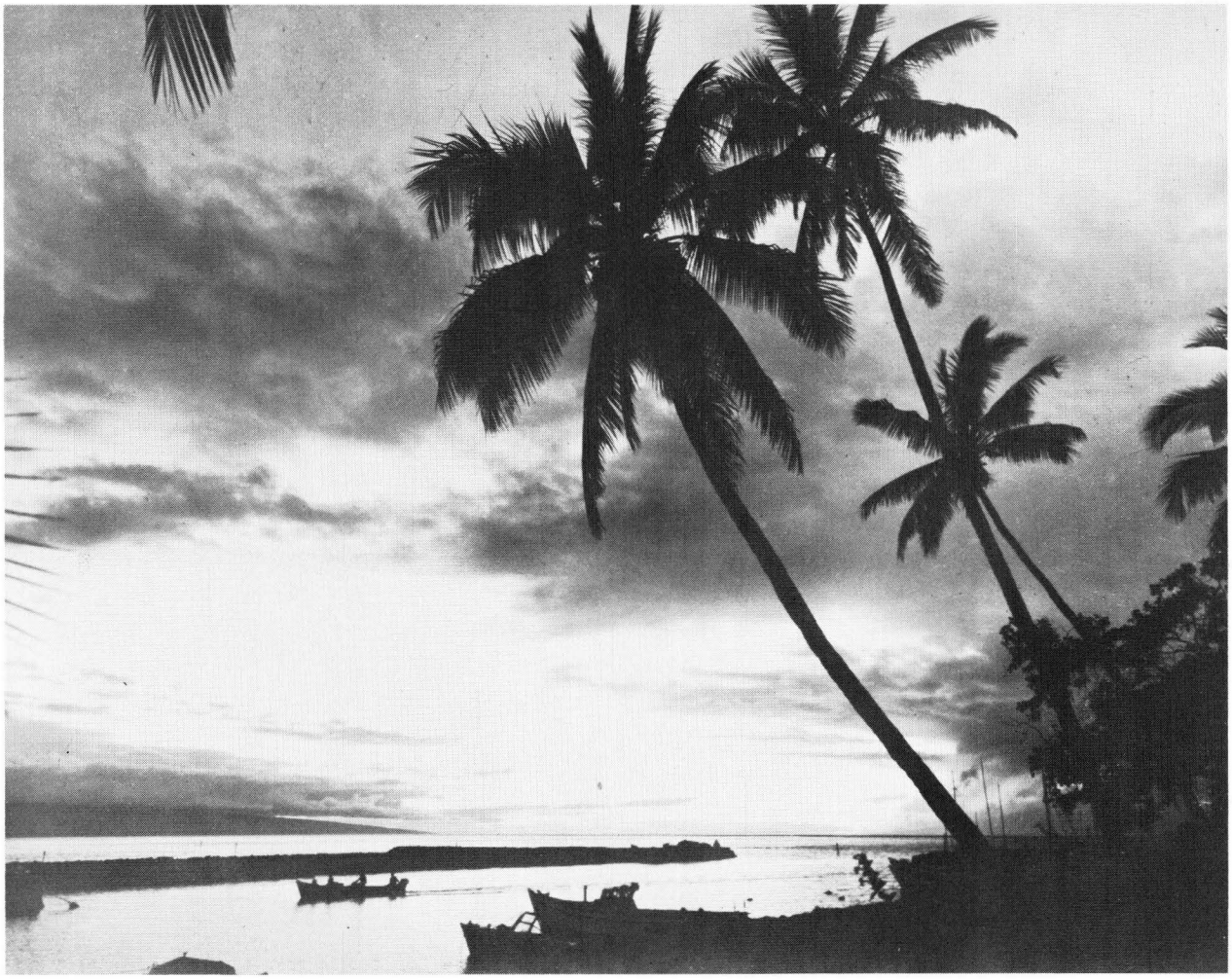
Demand for fresh "island pork" is only projected to increase 25 percent above the 1958–60 level by 1975. This rate of change in demand is significantly less than for other livestock products. The lower rate for island pork reflects the general trend away from pork consumption (on the U. S. mainland and in Hawaii) and the decline in the clientele for locally-grown, mainly garbage-fed "soft pork." As the local pork industry stakes its existence on the premium prices received for "fresh, island" pork, above prices of chilled or frozen mainland pork, its ability to grow is utterly dependent on the maintenance of demand for a differentiated product. Better marketing of cheaper mainland chilled pork is likely to lower any advantage of relatively expensive "fresh" local pork.

A gradual improvement in breeding stock, better nutrition, and faster maturing rates are assumed to increase output of live pork per sow-year by 20 percent (to about the present-day U. S. mainland levels of hog management) by 1975. Thus the breeding herd of sows and gilts in 1975 is projected at 4 to 5 percent above the 1958–60 level, or about 7,100 animals. Output of pork (live weight basis) in 1975 is projected at 14.5 million pounds.

Hog farming is expected to shift gradually from the close vicinity of Honolulu and its suburbs to other islands such as Molokai as interisland freight services are improved. Locally-grown feeds (by-products of sugar and pineapple production) are likely to assume more importance in island pork production. Less emphasis will be placed on garbage feeding.

NEW CROPS

Attention has been focused on crops and livestock products which have some commercial significance in the Islands, at the present time. Some are projected to have greater and, others, lesser, economic importance locally in 1975. The possibilities of developing major outlets for such products as fresh pineapple, papaya, passion fruit, guava, and macadamia nuts have been discussed. Are there any "new" products which may be unimportant now but which could be significant for the local economy in 10 to 15 years? This question can only be answered in the future. Those with high hopes for such items as acerola cherries, grapefruit, olives, tobacco, cocoa, vanilla, pepper, mango, lychee, corn, and Irish potatoes all face probable disillusion. A study of experience encountered with other seemingly "potential" crops is generally disheartening. So often, the enormous dif-



Tourism: 1 million tourists are expected in Hawaii in 1975. A scene of the coastline near Lahaina, Maui, the site of the first capital of the kingdom of Hawaii. (Hawaii Visitors Bureau.)

ficulties of establishing new markets in the very competitive food trade are forgotten. Other perennial handicaps for island farmers are the relatively high freight charges for goods shipped to the U.S. mainland, and the high cost of land, labor, and supplies. While the Islands seem to have the tantalizing quality of growing almost anything, economic limitations drastically reduce the choice of commodities that can profitably be produced.

Subsidies and other economic aid from the state or federal government can, of course, enable local farmers to overcome some of the difficulties which arise in developing new types of farming. In the long pull, however, unless island farming were to become a permanent drain on public revenues, it is comparative advantages which count. The main problem for island agriculture is to ensure that efforts are concentrated on products which have great competitive advantages. Traditionally, sugar and pineapple have held this coveted position. It seems most likely that their current dominating position will still be unchallenged in 1975.

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